DESCRIPTION

NETWORK CONTROL SYSTEM AND METHOD THEREOF

TECHNICAL FIELD

The present invention relates to a network control system for carrying out the operation of an AV apparatus etc. which is connected on the network via the network, and more specifically, to an apparatus control system and a method thereof using graphical user interface (GUI) that supports the user apparatus operation by graphics, characters, etc. on the screen.

BACKGROUND OF THE INVENTION

In recent years, an apparatus control system has been developed which displays graphics (icon) comprising screen display data that indicates apparatus functions on a TV screen and characters, etc., chooses and operates these graphics with a TV remote controller, and controls the apparatus. In addition, a network system has also been developed for receiving and transmitting video/audio data by connecting a digital apparatus such as DVC, etc. by using IEEE1394-1995.

An example of the conventional network control system includes the system disclosed in Japanese Unexamined Laid-open Patent Publication No. Hei 9-149325.

One example of the conventional network control system will now be discussed.

AV apparatuses are connected with a serial bus that can periodically provide equal communication chances to each piece of the AV apparatuses with another AV apparatus without change-over connections and in the interactive packet communication system as in the case of a digital interface such as the IEEE1394 standard.

Presently, each piece of AV apparatus stores its original screen display data by itself, and by the request of the controller (TV receiver) that has a graphic display function, the screen display data is transmitted to the controller and the controller displays the screen display data.

The controller has a function for inquiring the data that is required for displaying the AV apparatus which is connected and a function for controlling the display screen based on the screen display data from the AV apparatus.

The AV apparatus has a recording medium for storing the screen display data and a function for choosing the appropriate screen display data for the inquiry of the screen display data that is made by the controller.

In the network control system configured in this manner, the screen display data is stored in each device (AV apparatus) and by outputting the screen display data in accordance with the display request from the controller (TV receiver), graphics that are original (unique) to each device (AV apparatus) are displayed on the controller screen.

SUMMARY OF THE INVENTION

Technological Problems to be Solved by the Present Invention

However, in the above-described configuration, when the device changes the operation screen display by the state change of the inside, the state change of the device is unable to be notified from the device to controller, and an inconsistency is generated between the display screen information in the controller and the display screen information in the device, which causes a problem in that the apparatus operating information is unable to be correctly provided to the user.

In view of the foregoing problem, it is an object of the present invention to provide a network control system and the method thereof in which the configuration is simple and in which the device can quickly and efficiently notify this state change to the controller when the display of the operation screen is changed due to the state change inside the device. Moreover, it is also an object of the present invention for the controller and the device to definitely share the same state information, and at the same time, to ensure that the transmission load of the channel, the controller processing load, and the device processing load are small.

Means for Solving the Problems With the Conventional Systems

In order to solve the above-described problem, the network control system according to the present invention comprises a controller which is equipped with a user interface, and a device to be controlled. The device to be controlled has apparatus information in device and version information which is indicative of a version of the information that is inside the device to be updated when the apparatus information in the device is updated. Further, the controller reads the

apparatus information and the version information inside the device from the device and detects a change in device by the version information.

The apparatus information in the device is state information which is indicative of a condition of the device, and the device has the state information which is indicative of the condition of the device and the version information which is indicative of the version of the state information to be updated when the state information is updated. The controller reads the state information and the version information from the device and detects the change of the device by the version information.

The controller issues a notification request to the device for requesting a notification of the change of the state information when the controller uses the state information of the device, and the controller receives the version information as the primary response to the notification request. When the state information is changed in the device, the controller receives the updated version information as the secondary response with respect to the notification request.

The device has the state information which is indicative of the condition of the device and the version information which is indicative of the version of the state information, and the version information is updated when the state information is updated. The controller issues a notification request to the device for requesting a notification of a change of the state information when the controller uses the state information of the device, and the controller receives the version information as the primary response to the notification request. When the state information is changed in the device, the controller receives the updated version information as the secondary response with respect to the notification request and reads the state information between the primary response and the secondary response.

The secondary response from the device contains the updated version information and the updated state information.

The device has operation screen information which is indicative of an operation screen of the device and version information which is indicative of a version of the operation screen information. The controller reads the operation screen information and the version information from the device and detects a change of the operation screen information of the device by the version information.

The device comprises one or more objects and has the operation screen information which is indicative of an operation screen of the device and the version information which is indicative of a version of the updated operation screen information when the operation screen information is updated. The controller issues the notification request to the device for requesting a notification of a change of the operation screen information when the operation screen information of the device is displayed on the display screen, and receives the version information as the primary response to the notification request. Further, the controller receives the updated version information as the secondary response to the notification request when the operation screen information is changed in the device.

A network control system according to second aspect of the present invention comprises a controller which is equipped with a user interface, and a device to be controlled. The device to be controlled has a function information table which is indicative of a function and state of the device, component elements constituting the function information table, and element version information which is indicative of a version of the component elements of the function information table. The controller detects a change of information in the function information table by using the element version information when the controller uses the information in the function information table of the device.

The secondary response from the device contains the updated version information and the updated object information.

The version information is a counter value which is incremented each time the information inside the device is updated.

The device has a plurality of objects which constitute the operation screen of the device, and the objects comprise invariable objects which are not varied irrespective of the device state and variable objects which are varied in accordance with the device state. The controller reads the objects from the device, carries out caching to the invariable objects, and displays the objects on the display screen.

The device has an invariable data set comprising only the invariable objects and a variable data set comprising the variable objects, and the controller carries out caching to the invariable

objects.

A network control method of the present invention comprises holding apparatus information in the device, where the apparatus information contains apparatus configuration information which indicates device configuration information, and operation screen information which indicates a function and condition of the device and for configuring an operation screen of the device. When the held information is changed, the network control method generates version information which is indicative of a change generation thereof to carry out version management. Further, when a notification request is issued from the controller to the device in response to the change of the apparatus information in the device, the network control method sends a response to the controller from the device in response to the notification request, wherein the response from the device contains the version information.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of the device in the network control system according to a first embodiment of the present invention;

FIG. 2 is a block diagram of the controller in the network control system in the first embodiment of the present invention;

FIG. 3 is a system configuration diagram showing one example of the network control system of the first embodiment;

FIG. 4 is a configuration diagram of a function information table in the first embodiment;

FIG. 5 is an illustration of the network control system of the first embodiment;

FIG. 6 is a flow chart showing the processing of the controller in the first embodiment;

FIG. 7 is a protocol illustration of the network control system of the first embodiment;

FIG. 8 is a protocol illustration of the network control system of the first embodiment;

FIG. 9 is a configuration diagram of function information table according to a second embodiment of the present invention;

FIG. 10 is an illustration showing the menu configuration in the second embodiment;

FIG. 11 is a protocol illustration of the network control system of the second embodiment;

FIG. 12 is a flow chart showing the controller processing in the second embodiment;

FIG. 13 is a protocol illustration of the network control system of the second embodiment;

FIG. 14 is a flow chart showing the controller processing in the second embodiment;

FIG. 15 is a configuration diagram of the function information table according to a third embodiment of the present invention;

FIG. 16 is a block diagram showing a configuration example of the version information generating means in the third embodiment;

FIG. 17 is a flow chart showing the operation flow of the version information generating means in the third embodiment;

FIG. 18 is an illustration showing the changing condition of the version information in the third embodiment;

FIG. 19 is a configuration diagram of the function information table according to a fourth embodiment of the present invention;

FIG. 20 is an illustration showing one example of the screen display in the fourth embodiment; and

FIG. 21 is a protocol illustration of the network control system according to a fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawings, embodiments of the network control system of the present invention will now be described in detail.

First Embodiment

FIG. 1 shows a block diagram of the device in the network control system of the first embodiment of the present invention, and FIG. 2 shows a block diagram of the controller in the network control system in the first embodiment. Referring now to FIG. 1 and FIG. 2, the configuration and operation of the network system of the present embodiment will be described.

The device referred to herein means the AV apparatus, etc. which are subjects of control, and the controller means the apparatus for controlling these subjects of control. The device and the

controller may coexist in one apparatus or either one of them may exist. In addition, the apparatus corresponds to one node on the transmission line and the apparatus may be configured in such a manner so as to have a plurality of nodes in one housing.

First of all, in FIG. 1, numeral 1 denotes a transmission line, numeral 2 denotes a packet transmitting-receiving means, numeral 3 denotes a synchronizing data transmitting-receiving means, numeral 4 denotes a device signal processing means, numeral 5 denotes an asynchronous data transmitting-receiving means, numeral 6 denotes a device asynchronous data processing means, numeral 7 denotes an apparatus configuration information, numeral 8 denotes a function information table, numeral 9 denotes an apparatus inside control means (in-apparatus control means), numeral 15 denotes a write inhibited memory region (ROM) with part of the function information table 8 arranged therein, numeral 16 denotes a write enabled memory region(RAM) with part of function information table 8 arranged therein, numeral 17 denotes a function information managing means, and numeral 18 denotes a version information generating means.

Herein, the transmission line 1 is a serial bus (1394 bus) which is specified by, for example, the IEEE1394 standard (IEEE1394-1995 and any high-order standard that is compatible with this), and can transmit and receive the synchronous data and asynchronous data by a time sharing method and others. The synchronous data is transmitted by the use of a plurality of channels which are divided by the time sharing method, and the band zone of each of these channels can be set individually. The transmission line 1 may not always be a 1394 bus, and ATM, Ethernet, infrared ray transmission, and other transmission lines may be used instead.

The packet transmitting-receiving means 2 provides a physical and electrical interface with the transmission line 1, and at the same time carries out mediation of the right to use the bus and cycle control for synchronous transfer, etc. In addition, the packet transmitting-receiving means 2 sorts out and receives packets on the transmission line 1 in accordance with addresses and transmits packets onto the transmission line 1.

The synchronous data transmitting-receiving means 3 controls the transfer rate (data division) or adds headers when the data is transmitted. For example, when the AV protocol (IEC61883) standard of the 1394 bus is used, a CIP (common isochronous packet) header is added

by the synchronous data transmitting-receiving means 3. Conversely, when the data is received, the synchronous data transmitting-receiving means 3 rearranges the receiving packets in a correct order and removes headers, etc.

The device signal processing means 4 receives the synchronous data from the synchronous data transmitting-receiving means 3 and carries out signal processing that fits to the device. For example, if this device is a recording-reproducing apparatus such as a digital VTR, etc., the device records the synchronous data to the recording media (for example, the magnetic tape). Furthermore, the device signal processing means 4 takes out the synchronous data from the recording media, broadcasting waves, etc. and transmits them to the synchronous data transmitting-receiving means 3.

The asynchronous data transmitting-receiving means 5 carries out transaction processing of the asynchronous data that conforms to the protocol of the transmission line 1, and, for example, in the case of the 1394 bus, carries out read-transaction, write-transaction, lock-transaction, and other processing. The asynchronous data transmitting-receiving means 5 may be configured with software. The device asynchronous data processing means 6 processes asynchronous data that is received from the asynchronous data transmitting-receiving means 5 and transmits the processed data to the appropriate component element in the device. For example, if the asynchronous data which the device asynchronous data processing means 6 receives is the control code and the user operating information, the device asynchronous data processing means 6 judges the validity, and if it is valid, the device asynchronous data processing means 6 gives an instruction to the in-apparatus control means 9 to execute the function corresponding to the control code and the user operating information.

The device asynchronous data processing means 6 may be intended to transmit the control code and the user operating information to the function information control means 17, and in such an event, the function information control means 17 judges the validity of these, and if it/they is/are valid, the function information managing means 17 instructs the in-apparatus control means 9 to execute the functions shown by the control code and/or the user operating information.

When the apparatus configuration information 7 is required by the controller, the device

asynchronous data processing means 6 sends out the information held in the apparatus configuration information holding section 7 to the controller via the asynchronous data transmitting-receiving means 5, etc. in conformity with the request received via the asynchronous data transmitting-receiving means 5, etc.

In addition, the device asynchronous data processing means 6 sends out the asynchronous data from the component element in the device to the asynchronous data transmitting-receiving means 5 in conformity with the instructions from the in-apparatus control means 9.

The asynchronous data transmitting-receiving means 5 and the device asynchronous data processing means 6 may be configured as one means.

The apparatus configuration information 7 indicates the configuration information of the apparatus and is described in conformity with the rule shown by the configuration ROM of CSR (command and status registers) architecture that is specified by, for example, the ISO/IEC 13213:1994 standard. When the 1394 bus is used, the apparatus configuration information 7 has a unit directory containing the bus information which this apparatus is compatible with, such as whether the apparatus supports the bus manager or isochronous operation, or information on whether the apparatus supports the AV protocol, and the apparatus configuration information 7 also has the unique ID, which is the identifier of this apparatus, etc. In addition, in the apparatus configuration information holding section 7, the information parts of the device as discussed below are described.

The function information table 8 is a table of information for configuring the operation screen of this device (operation screen information), that is, a list of information indicating the device functions and state. In this function information table 8, an object which is required for configuring the operation screen of the device, such as identifiers (ID) for identifying this object, etc., are included. This object is the component of the operation screen information, and is a function menu, display parts, a text data object, a still picture data object, etc.

Each object has a hierarchical structure of a list form, and in the present specification, each data object and list itself are generically called as the object. That is, for the object information, there are data object, lists, various header information, and unique information as discussed below

with reference to FIG. 4. By the way, each object does not always need to take the list structure, but may be configured by the data object only, or by the unique information and data object.

Each object has the type information that indicates the type of the object, attribute information that indicates the configuration such as whether or not the object has a child object, etc. or not, size information that indicates the size of the object, etc. at the header section in addition to the identifier (ID) for identifying each object. In addition, each object indicates the child object by the ID information in the entry that is mentioned in the list.

Here, display parts mean those that are locally displayed on the screen, such as icons, buttons, sliders, check boxes, text entries, etc., and there are still picture data such as apparatus operating buttons, etc., text data that indicates functions, etc., audio data such as effect sounds, etc., and program codes including still picture data and text data, etc. Moreover, the information of the function information table 8 is transferred to the controller via the device asynchronous data processing means 6, asynchronous data transmitting-receiving means 5, etc. in accordance with the request from the controller on the transmission line 1.

This function information table 8 is arranged in the ROM15 and RAM16. In the ROM15, the information which is inherent to the device and which does not need to be frequently rewritten, that is, objects such as still picture data that shows the apparatus operation buttons, etc. are stored. The ROM15 may be configured with flash ROM, and in this event, the functions themselves of the apparatus can be rewritten.

In the RAM16 to which this function information table 8 is arranged, the controller on the transmission line 1 and the in-apparatus control means 9 write objects via the function information control means 17 as required. The information written in this event are contents information, operating state information, etc.

This contents information is the program information (program title, title screen, theme music, outline, information on the cast, etc.) which is presently broadcasted in the case of, for example, a set top box (STB), and in the case of a DVD, the contents information is the information of contents that are recorded in the DVD disk (title, title picture, theme music, outline, cast, and other information).

The operating state information means objects such as display parts, etc. that show the apparatus operating state (e.g., during reproduction, during rewinding, during record reservation) in the case of , for example, a VTR. Furthermore, information which is required for network control such as controller identification information, etc. that is used for this device or date and time, channel No., etc. of record reservation may be written here.

In the present specification, the information that indicates the device condition include the contents information described herein and operating state information. In addition, for example, as in the case of VTR reproducing buttons, the condition of each display part, such as still pictures when the button is pressed and the still pictures when the button is released, is included.

The function information managing means 17 converts the object identifier (ID) to the address of the ROM15 or RAM16. In addition, the function information managing means 17 does not simply convert the address but, for example, when the data size becomes excessively large because some display parts are rewritten and the data is unable to be written in the original address region, the function information managing means 17 assigns a new address.

Consequently, it becomes possible to read and write each of the objects from the controller on the transmission line 1, the in-apparatus control means 9, or the device asynchronous data processing means 6 with the identifier (ID) of the object.

When the address of each object, etc. is known, the ROM15 or RAM16 address may be used to read and write the object. In addition, these may be combined to read and write display parts, etc., and objects may be read and written by the relative address in the display parts shown in the identifier (ID).

In addition, the function information managing means 17 controls the object identifier (ID) of each object. For example, when an object is newly added, the function information managing means 17 gives the newly added object a unique identifier (ID) which is not of other existing identifiers (ID). Conversely, when an object is deleted, the function information managing means 1-17 nullifies the object identifier (ID) of the deleted object.

The function information managing means 17 may be configured in such a manner so as to submit the information of the changed display parts (object ID, or ID and object itself) to the

controller when the display parts are changed, and in such event, it is not necessary to constantly monitor the objects which may cause the controller to change. Further, the controller processing is able to be reduced, and it becomes possible to easily take action against the object that indicates the operating state information or contents information that varies over time.

The version information generating means 18 carries out version control such as the frequency of information state change generation in the function information table 8, and is configured by the use of counters, etc. Every time the information stated in the RAM16 in the function information table 8 is changed, the counter reading in the version information generating means 18 is incremented by the function information managing means 17. This counter is an endless cyclic counter of a finite bit length with a sufficient bit length so that when the maximum value of the counter is incremented, the value of the counter becomes the minimum value.

The counter bit length is optional, but it is desirable for the device to have a sufficient bit length so that the counter value does not make a circuit at least within the time while the controller has a control right or a subscribing right of a state change in order to prevent the different function information table 8 from being presented at the same counter value.

When a notification request is issued on the stage change in the device (for example, a change of information of the the function table 8) from the controller to the device, the version information is included in the primary response and the secondary response to the notification request. It may be configured to provide a plurality (three or more) responses to one notification request, or to include the version information at that time in each response, and in such a event, the device state change is definitely able to be identified and, at the same time, the traffic on the transmission line is able to be reduced.

By the way, in each response, the version information which is shown with this counter value may be included or the response may be given simultaneously with other information attached thereto.

In addition, when the controller reads the information of the function information table 8, because this counter value is read by the controller together with the information on the function information table 8 and the counter value indicates the version information of the read function

information table 8, the controller is able to confirm the version information and the reliability thereof is able to be improved in identifying the device state change.

The in-apparatus control means 9 controls each component that includes the mechanism, etc. inside the device, and if the data which the device asynchronous data processing means 6 receives is the control code that indicates the device action, the in-apparatus control means orders the device to act in conformity with the control code according to the instructions of the device asynchronous data processing means 6.

The action of the device to the request, etc. from the controller takes place as follows. First of all, when the device is connected to the transmission line 1 or the controller is connected to the transmission line 1, the controller first reads the apparatus configuration information 7 of the device, confirms the location of device information parts (as will be described below with reference to FIG. 4), and reads the device information parts.

The apparatus configuration information 7 may be configured so as to have the address information of the function information table 8 or to only show the existence thereof. In addition, the apparatus configuration information 7 may be configured to not have the information of the function information table 8 or to only have the information of the device information parts 50. In such an event, the controller issues a command to request device information parts 50, a function menu 51, or display parts 52 in the function information table 8 and acquires the information of the function information table 8. In such an event, the controller may be configured so as to issue the command to request part of the function information table 8, for example, display parts only, and to acquire the display parts and this ID only.

In addition, when the device receives the control code and the user operating information from the controller, the device carries out processing that is shown with the control code and user operating information in accordance with the conditions.

When, for example, the control code of this object is transmitted from the controller together with the user operation "selection" for the object such as display parts, etc. for showing the device function, the asynchronous data transmitting-receiving means 5 gives an instruction to the in-apparatus control means 9 to carry out the function that is shown by this object.

By the way, the object which is referred to here is the display parts 52 or the function menu 51, and it is possible to use the identifier of the display parts list, the identifier of the function menu list, the identifier of the data object, etc. as the object control code.

In this way, for the request of the GUI (graphical user interface) information from the controller, the device is only allowed to present the information of the function information table 8, and thus, the device load may be able to be reduced. In addition, for each of the device functions, there is no need for the standardization organization, etc. to specify commands, and even the device, to have a new function which is unable to be assumed presently, can easily use this new function via the transmission line 1.

The components of the synchronous data transmitting-receiving means 3, the device signal processing means 4, etc. may be configured optionally in conformity with the device functions or they may not be included. In addition, each means may be configured either by hardware or by software.

Here, the device functions are specified by the user operating information and the object control code, but the device function may be able to be configured in such a manner so as not to approve anything other than "selection" for the user operation. In such an event, since the device function is able to be defined only with the object control code, the device can execute the device functions only with this control code, and the packet size to be transmitted can be reduced.

Further, the control code is designated to the ID of the object, but the control code may be optionally set by the device. For example, the control code may be configured with the number that is given by the kinds of the device functions and the serial No. for each kind, or the unique control code which is used inside the device may be used, and in such an event, the mounting of each function inside the device is able to be facilitated.

FIG. 2 shows the block diagram of the controller inside the network control system of the first embodiment. In FIG. 2, numeral 10 denotes the controller signal processing means, numeral 11 denotes the controller asynchronous data processing means, numeral 12 denotes the function information table managing means, numeral 13 denotes the function database, and numeral 14 denotes the display/function selecting means. In FIG. 2, like reference numerals designate like

constituent elements in FIG. 1 and the explanation thereof is omitted.

The controller signal processing means 10 receives the synchronous data from the synchronous data transmitting-receiving means 3, and carries out signal processing in conformity with this controller. For example, if this controller is the apparatus which is capable of displaying videos such as a video monitor, etc., the controller decodes the synchronous data (for example, MPEG2 stream) and displays the data on the screen.

The controller asynchronous data processing means 11 processes the asynchronous data that is received from the asynchronous data transmitting-receiving means 5 and transmits the processed data to a suitable component inside the controller. In addition, the processing means 11 secures and sets the band zone channel for the synchronous data, etc.

In addition, the controller asynchronous data processing means 11 receives the information of the device on the transmission line 1 such as the connection of a new device, removal of the existing device, etc. as well as contents, etc. of the device function information table 8 via the asynchronous data transmitting-receiving means 5, and transfers the information and/or contents to the function information table managing means 12.

Furthermore, the controller asynchronous data processing means 11 sends out the asynchronous data from the component in the controller to the asynchronous data transmitting-receiving means 5 in conformity with an instruction from the display/function selecting means 14. In this event, the asynchronous data transmitting-receiving means 5 and the controller asynchronous data processing means 11 may be configured as one means.

When the controller and the device are configured in the same apparatus, since the control which is known by the controller or which is inside the apparatus is directly carried out by the in-apparatus control means 9 of the device, the function as a device inside this apparatus has a function information table 8 as a device but is not registered to the function database 13 inside the apparatus. By the way, in such an event, the function information table 8 may have the location described in the apparatus configuration information 7 and, at the same time, may be registered to the function database 13 in advance.

When the controller and the device are configured in the same apparatus, the controller

signal processing means 10 and the device signal processing means 4 as well as the controller asynchronous data processing means 11 and the device asynchronous data processing means 6 may be configured as the same means.

The function table managing means 12 controls the information of the function information table 8 which is received from the device on the transmission line 1, and when the function table managing means 12 receives the information from the controller asynchronous data means 11 that a new device is connected, the function table managing means 12 gives an instruction to the controller asynchronous data processing means 11 to read the information of the function information table 8 of this new device.

Then, when the information of the function information table 8 and the version information of the new device are read, the function information table 8 is registered to the function database 12 and, at the same time, the version information of the function information table 8 is stored in relation to the function information table 8. In this event, the place where the version information is stored in memory may store the version information together with the function information table 8 in the function database 13, or the function information table managing means 12 may store and manage the version information.

When receiving the information that an existing device on the transmission line 1 has been removed, etc., the corresponding function information table 8 is deleted from the function database 13.

Here, the function table managing means 12 may be configured to not delete the function information table 8 when the existing device is removed, but to store the function information table 8 in the storage means in the controller. When the device is connected again, the function table managing means 12 may identify this device with the device identifier, etc., read the function information table 8 from the storage means inside the controller, and register the table to the function database 13, thereby enabling the quick registration of the connected apparatus. The function information table 8 in the controller is not necessarily of the same exact form as that of the function information table inside the device but is allowed only to contain the same information.

The function database 13 is arranged in the rewritable memory space and configures the

function information table 8 that is received from the device as a database. By searching this database by the use of the function information table control means 12, it is possible to export objects such as the information of each device, information of each function, and ID that corresponds to these objects, the display parts for notifying the object to the user, display parts that are displaced when the user operates these display parts or control codes to be transmitted, etc.

It is not always necessary for function database 13 to always have all of the information of the function information table 8. Instead, the function data base 13 may hold only the required section.

The display/function selection means 14 notifies the user of the display parts (video/audio/character information, etc.) that show the device GUI information or function GUI information, etc. on the controller screen and, at the same time, gives instructions for choosing the device and function in accordance with the user operation in addition to giving instructions to execute each function.

The display/function selection means 14 may be also be able to display/reproduce the data that is received from the controller signal processing means 10 (for example, video and audio data) or the data that is received from the controller asynchronous data processing means 11.

In such an event, the GUI information, etc. may be overlay-displayed on the video data that is received from the controller signal processing means 10 or on the GUI information display screen, and the video data display screen may be changed and displayed by the instructions, etc. of the user.

In addition, the display/function selection means 14 gives instructions to the function table managing means 12 to search the function information table 8, and displays devices on the transmission line 1 and display parts (device name, function name, still pictures for display, etc.) that indicate the functions of the devices which are displayed on the screen.

When the user selects the display part that indicates the device, the display/function selection means 14 reads the menu of this device form the function information table 8 and displays the read menu on the display screen.

When the user selects the display part that indicates the function, the display/function

selection means 14 issues the control code to the device, which corresponds to the display parts that are obtained from the function information table 8 and the user operating information, via the controller asynchronous data processing means 11, etc. The display/function selection means 14 receives the control code and the response of the device to the user operation information via the controller asynchronous data processing means 11. Further, if there is any instruction to change the display parts from the device using the version information in this response, the display/function selection means 14 checks the version information, and if the version information is updated, follows this instruction, imports the display parts to be changed from the device, displays the appropriate display parts with respect to the current device state, etc., and notifies the user.

It is not always necessary for the controller to understand all of the functions of the device. For example, for the device with new functions which are unable to be predicted at the present time, the controller can import the display parts with respect to this new function from the function information table 8, display the imported display parts on the screen, and notify the user.

When the user understands the new function with these display parts and selects the function, the display/function selection means 14 of the controller refers to the function information table 8, acquires the control code corresponding to this new function, issues the control code and the user operation to the device, and allows the device to execute this new function. Consequently, by taking the above-described configuration, the user is able to execute new functions which are unable to be assumed at present.

The components such as the synchronous data transmitting-receiving means 3, the controller signal processing means 10, etc. may or may not be configured optionally in conformity with the controller functions.

FIG. 3 shows the system configuration of the network control system of the first embodiment.

In FIG. 3, numeral 21 denotes a television (TV), numeral 22 denotes a remote controller for the TV 21, numeral 23 denotes a personal computer (PC), numeral 31 denotes a recordable and reproducible DVD, numeral 32 denotes a digital VTR (DVC) of the DV system, numeral 33

denotes a digital VTR (DVHS) of the VHS system, numeral 34 denotes a digital movie (DVC movie) of the DV system, and numeral 35 denotes a set top box (STB) such as CS digital broadcasting, etc. Herein, these elements are generically referred to as a video/audio/information apparatus.

These video/audio/information apparatus are connected by the transmission line 1 and compose an AVC system. However, the video/audio/information apparatus is not limited to only the above-described elements and may include all of the present apparatuses in each of the fields of image, acoustic, and information (for example, printers, minidisks, etc.).

The TV 21 is an apparatus comprising the controller and the device (ground wave tuber, video monitor), and uses a remote controller 22. The user can give an instruction to the display/function selection means 14. The PC 23 is an apparatus comprising a controller and devices (modem interfaced with the telephone line, video monitors, etc.), and the user gives instructions to the display/function selection means 14 by using the keyboard, mouse, etc of the PC 23.

The TV 21 and the PC 23 are defined as the apparatus integrating devices and a controller, and of the device functions in the apparatus, functions which are used from other apparatuses are stated on the function information table 8, and their own functions are not registered to the function database 13 of the controller section inside the apparatus. In addition, the TV 21 and the PC 23 are defined as an apparatus comprising devices and a controller, have a function information table 8 for each device in the apparatus, and register each function information table 8 in the apparatus to the function database 13 of the controller in the apparatus.

The DVD 31 and the DVC movie 34 are devices that can record and reproduce AV data. The DVC 32 and the DVHS 33 are apparatuses comprising devices that can record and reproduce the AV data and devices that have digital broadcasting tuner functions. The STB 35 is a device that has tuner functions for receiving CS digital broadcasting.

In the first embodiment, the DVD 31, the DVC 32, the DVHS 33, the DVC movie 34, and the STB 35 are defined as devices, but if the environment in which other devices are operated by liquid crystal panels, etc. is realized and the user can carry out operations, such as choosing

functions of other devices by the touch-sensitive panel, remote controller, etc., they may be the apparatus containing the controller and devices.

These apparatus may be configured to contain processing functions as a controller and at the same time have a remote controller for the apparatus so that only displays and voices are allowed to be displayed on the monitor by analog connections, etc., and the devices are operated by a remote controller of the apparatus while the user is watching the screen. In such an event, this apparatus may be the apparatus that can contain the controller and devices.

FIG. 4 is an illustration of the function information table in the first embodiment.

In FIG. 4, numeral 50 denotes a device information part, numeral 51 denotes a function menu that indicates component assembly parts, etc., and numeral 52 denotes display parts. By the way, in this event, FIG. 4 shows a logical configuration of the function information table, and the physical layout is optional.

Each part of the device information parts 50, the function menu 51, and the display parts 52 comprises an object of a list form, and data objects which do not have child objects (text objects, still picture object, etc.). Herein, the lists are generically called objects. That is, for the object information, there are data objects, lists, various header information, and unique information. Each object does not always have to take a list structure, and may be configured with data objects only or with unique information and data objects.

At the header section, each object has an identifier (ID) for identifying the object, type information that shows the type of the object, attribute information that indicates the configuration whether the object has a child object or not, etc., size information that shows the size of the object, and others. Each object shows the child object by the ID information in the entry stated in the list.

For the objects such as text objects, etc. which have a small data amount, the objects themselves may be entered in the entry section in the list. The unique information of each list should be entered in the header, etc. in each list, and the unique information of the data object should be entered in the entry. In addition, the unique information may be stated in either the object or the entry.

The physical/logical configuration of the function information table 8 in the controller may

not always be the same as the function information table 8 in the device, and at least, the information the controller presently requires should be same as that in the device.

That is, each part inside the function information table 8 does not have a physical link (relation between entry and the actual substance) as shown in FIG. 4, and may allow access from the controller object by object.

The device information part 50 is the part showing the device information. In the device information list in the device information part 50, the category of protocol and commands which this device supports, the device type with this device type coded, the version information of this device, etc. are entered as unique information. The device type may be defined to indicate the code and character string that is shown by, for example, the subunit type of the AV/C Digital Interface Command Set (AV/C-CTS) which is discussed in 1394TA (1394 Trade Association). Consequently, with this information, the outline of this device function, for example, whether it is a VTR or STB, can be identified.

It is possible for the device information part 50 to have the information of the function information table 8 itself, and the support level and size of this function information table 8, the maximum transfer amount that can be sent by one asynchronous transfer of this apparatus, and others may be entered as the unique information.

These pieces of information may be entered in the device information list and a route list may be prepared as a parent list of this device information list, in which such information may be entered.

In this event, it becomes possible to determine only by looking to this part, for example, to what level the controller could support, how much memory space must be secured, how much transfer amount per case should be decided, etc. before the controller reads all of the function information table 8, thereby enabling the elimination of wasteful transfer.

The device information part 50 is recorded as part of the apparatus configuration information 7 from the physical viewpoint, and is configured in such a manner so as to enable direct reading from the controller via the transmission line 1, but the physical layout should not be limited thereto. In the apparatus configuration information 7, the identifier (ID) of the function menu that shows the

main menu of this device is entered. Even the device that has no menu which shows functions is able to have the information of the device itself, and integrity between apparatus can be maintained.

The device information part 50 has the user interface information of the device, in which display parts such as the device name with this device being name indicated in the character string, the model name with the model No. of the products shown in the character string by the manufacturer are arranged, and each of these is one text object. By the way, in this case, no list is used for these display parts, but they may be configured by the use of the display parts list.

In the first embodiment, as a still picture object, the device information part 50 has display parts such as still picture objects showing devices such as icons, etc. of the device exist. These text objects, still picture objects, etc. have entries inside the device information list. By the way, the device information parts 50 may have the audio object and the data showing this device such as music, etc. arranged.

The pseudo videos comprising a plurality of still pictures may be used in place of still picture objects, and in such an event, the operation screen which is more familiar to the user is able to be configured.

This pseudo video is able to be used at the function menu 51, other display parts 52, etc. in place of the still pictures. In this event, each object is intended to have the entry in the device information list, but with respect to objects with the same objectives, the list is defined and the objects may be configured to have entries in this list. Furthermore, objects may be configured to have relevant lists in accordance with the GUI classifications (display, selection, in operation, in application, errors, etc.), and in such an event, displays which are easier to be understood by the user can be provided.

The function menu 51 shows a menu which is an aggregate of display parts 52 that show device functions, and comprises function menu lists. The function menu list is configured with function menu lists. The function menu list is linked from the menu entry inside the device information list, and has an entry of display parts that would show the operation screen and list itself. Consequently, it is possible to trace the function menu from the device information parts 50.

However, in the first embodiment, by making an inquiry on the right to use the device, the function menu can be read.

By the method of predetermining an ID of the function menu list, direct access to the function menu 51 may be obtained without tracing from entries of the device information list. In this event, the display part 52 for the operation screen is a display element that shows the device function and status, is one of the components of the function information table 8, and is arranged by the use of the display parts list. For the entry of each display part, flags that show the objectives and operation (for display, for identification, for control, etc.) of this display part or flags that show whether or not this function may be dynamically lost may be added. By the way, as shown in FIG. 4, the display part 52 that shows the function menu 51 itself may be mentioned without using the display parts list. In this way, optional display parts may be arranged without using the display parts list.

The data objects are arranged to the display parts list that shows this display parts entry.

The entry of each display part may be directly arranged in the function menu list without using the display parts list, and in such an event, flags, etc. that indicate objectives may be mentioned in the entry of each display part.

Furthermore, the function menu list 51 has the information for configuring the apparatus operation screen, and has the information such as screen size which the function information table 8 assumes, as well as background color, background patterns, etc. in the header inside, etc. as the unique information.

On the other hand, the data objects (texts, still pictures, etc.) that indicate this function menu list itself have direct entries in the function menu list 51.

For the data object that shows the list itself, the display parts list may be used. In addition, the information that shows these lists themselves may be distinguished from other data objects or display parts by the use of flags, etc.

The display parts 52 are parts for displaying icons, buttons, sliders, check boxes, text entries, etc., and in these display parts lists, they have unique information such as display parts type, information which is required for each display part (for example, in the case of the slider, variable

range, step value, initial value, etc.), etc.

In addition, the display parts list 52 has text objects, still picture objects, and other entries, and in this entry, the display parts list has the unique information such as flags that show the kind of texts and still pictures (format), etc., and furthermore, positional information on the screen for showing the relative position to the menu screen which the device assumed.

(Layout Information)

In addition, each display part list 52 may have the layout information that shows the mutual relation of display parts with respect to display parts which are in close relation from the functional and screen design viewpoints as relational information that has the same information (for example, the same value). That is, when the screen size that is assumed by the device function information table 8 is greater than the screen size of the controller, the controller is unable to display the display screen that is shown in this function table 8, and therefore, the layout of the display parts in the function information table 8 is rearranged by the controller and are displayed by being dividing into a plurality of pages.

In this event, a plurality of display parts in a close relationship may have the relational information with the same information (value) and belong to one display set to be arranged close to each other. By this relational information, the display parts that belong to the same display set are arranged close to one another in one page.

The display parts with a close relation referred to here are, for example, a VTR reproduction button and stop button or TV channel UP button and DOWN button, which are used in pair, a ten-key pad that indicates TV channels and TV aspect switching key (4 to 3, 16 to 9, letter box, full screen display, etc.) which show similar functions, or those which are easier for the user to understand when they are arranged close to each other from the viewpoint of the screen design. Which display parts should be arranged close to each other in this relational information is decided uniquely by the device manufacturer. By the way, this relational information may be mentioned in the header as the unique information. In addition, all the display parts should not always have this relational information, which should be added only to display parts which belong to any display sets that are to be arranged close to each other.

In the case of new functions which are unable to be assumed presently, by arranging the still picture, etc. that shows this new function as a display part, the data of this new function is transmitted to the controller, and the information on this new function is able to be presented to the user.

FIG. 5 is an illustration of the network control system in the first embodiment, and with reference to FIG. 5, the control operation of the controller and the device will be explained.

First of all, when the device is connected to the transmission line 1, the controller on this transmission line 1 recognizes the new device by bus resetting, etc. if the transmission line 1 is the 1394 bus. According to the instructions of the function information table control means 12, the controller reads the device information part 50 from the new device through the transmission line 1, reads and registers this device information part 50 to the function database 13 of the controller as part of the function information table 8 of this device.

The physical/logical configuration of the function information table 8 in the controller is not always same as that of the function information table 8 inside the device, but at least, the information which the controller needs at this present moment should be same as that in the device.

That is, each part in the function table 8 does not have a physical link (relation between entry and the actual substance) as shown in FIG. 4, and may allow access from the controller object by object.

Each function information table 8 is identified by the unique ID, etc. which is original to each device and has a list structure to have an entry for each device. The information of the function information table 8 may all be read at once or only a part of the function information table 8 may be read. Further, the information may be read object by object or list by list.

For example, the identifiers (IDs), etc. of the device information list and function menu list are decided in advance and the controller may make direct access by the use of these IDs. Alternatively, the controller may communicate with the device, acquire these Ids, and make access to the information. Furthermore, the function menu ID may be included in the primary response from the device side to the notification request (as discussed below) from the controller.

In the controller, each display part is identified by IDs combining the unique ID which is

original to the device with IDs of display parts which the device gave. The controller may be configured to give a new ID of each display part and to have a conversion table of this new ID with the unique ID (unique ID of the device + ID given by the device). In this function information table 8, the display parts with IDs are included.

The display/function selection means 14 refers to the function information table 8 (or part of the function information table 8) in the function database 13 through the function information table managing means 12.

When the display/function selection means 14 displays a table to devices that are connected to this controller, the display/function selection means 14 uses the function information table control means 12 to read the data objects (text objects, still picture objects, etc.) that belong to the device information parts 50 from the function information table of all the devices that are registered to the function database 13, and displays these on the screen.

There is no need to display all the data objects of the device information parts 50 on the screen, but to display properly sorted out data objects.

When there is any audio object in the device information parts 50, the audio object is not used when the device table is displayed, but, for example, when the new device is connected with the device table already displayed, the still picture object of this new device is displayed and, at the same time, if there is an audio object, the audio object is reproduced.

Then, when the user selects, for example, the device still picture object by using the pointing function (for example, cross-shaped key), etc. of the remote controller, the display/function selection means 14 issues a request for the main menu to the function table managing means 12. The function information table managing means 12 reads the function menu 51 that shows the main menu of this device and the display parts that belong to this function menu 51, and stores them in the function information table 8 in the controller.

In such an event, first of all, the controller transmits the notification request 101 shown in FIG. 5 to the device as a command and declares that the controller grasps the device condition and controls its action. As a response to this, the device returns the primary response 111, and in this primary response 111, the version information that indicates the initial value, generation No. "1,"

etc. of the function information table that indicates the device functions are contained.

In this event, the version information is expressed by the function menu 51, the main of the version information, and the generation No., etc. that indicate display part 52 under this or function menu 51, etc., and is expressed by the counter value, etc. which are incremented each time the information inside the device is updated. By the way, the version information may be configured in such a manner as so to indicate the version of the function table including the device information parts 50 as well as the function menu 51 and the display part 52.

For the primary response 111, the identifier (ID) of the function menu 51, which becomes the main inside the device, may be returned, and in such an event, the device is enabled to change the main menu easily by itself.

Then, in order to acquire the contents of the function menu 51, the function information table managing means 12 inside the controller transmits the menu request 201 to the device, and the device returns the list (function menu list) that shows the identifier (ID) of display part, etc. which is contained in the function menu 51. If there are objects composed using the list in the function menu 51, the identifier of the relevant object list which is contained in the function menu 51 is returned.

The function information table managing means 12 inside the controller sends a display parts request 221 with the identifier of the display parts attached thereto in order to acquire the entity of each display part and acquires each display part with the display part response 231, which is the response to display parts request 221. In this event, the display parts may read those that belong to the intended function menu 51 as a whole or one by one. In addition, as a response to the menu request 201, all the display parts that belong to the function menu 51 may be transmitted. When the display parts are read, the display parts list 52 and the data object (text object, still picture object, etc.) may be accessed separately and read.

In this way, the information of the device function information table 8 is read by the function information table managing means 12.

Consequently, the display/function selection means 14 reads the display parts 52 from the function information list of each function that is mentioned in the function menu list by using the

function information table managing means 12, and displays the display parts corresponding to each function on the screen. By this, on the screen, it becomes possible to display the display parts that show all the functions of this device.

In this case, too, each display part is identified by the unique ID of the device and the ID of each display part.

Next, when the user selects the display parts that show, for example, reproducing functions of the device by using the pointing functions, etc. of the remote controller, the display/function selection means 14 transmits the identifier (ID) of the display parts 52 which are designated by the device as the control code together with the user operation information (for example, "selection"). That is, even when with the cross-shaped keys that indicates the top and bottom and right and left of the remote controller, the cursor is moved on this display part and the selector button is pressed and then released, and the ID of this display part 52 (control code) and the user operating information ("select") are transmitted to the device as the operation request 241.

It is also possible to send additional subtle user operating information to the device, and when "press," "release," "press twice," and other operations are carried out to the display parts 52 by the remote controller and the pointing device operation, the additional operation information is able to be transmitted to the device.

The user operating information may be coded and may be sent together with ID of the display part 52, or each information may be sent as one command (the operand is control code such as ID, etc. of the display part 52).

When the selection operation only is allowed to the display part 52, etc., it may be configured to transmit the control code (identifier: ID) of the display part only to the device, and processing can be simplified and, at the same time, the traffic of the transmission line 1 can be reduced.

As responses to the operation request 241, in the operation response 251, responses such as whether or not the operation request 241 is received, rejected, or not supported by the device are returned.

Then, when the state in the device changes and the objects (function menu list, display parts

list, data object) in the device change, the device returns the secondary response 121 to the notification request 102. In this secondary response 121, the version information and identifiers (ID) of objects that are changed are included. Although, in this case, it is stated that identifiers of objects that are changed are included, it may be stated that when a plurality of display parts 52 which are included in the function menu change, identifiers of the function menu are returned. Furthermore, it may also be stated that identifiers of objects changed are returned as the secondary response in the same manner when objects that belong to the device information parts 50 change.

The function information table managing means 12 detects that objects in the device have changed by receiving this secondary response and by using the identifier of the changed object, requests the changed object by the object request 261, and as the response to this, in the object response 271, this changed object is acquired. In this case, the process was generalized for explanation, but, for example, if the changed object is the function menu 51, the menu request is carried out as this object request 261, and for the object response, the menu list response is obtained and the function menu list 51 is acquired, and the controller checks the display parts list that is changed in the function menu list, requests display parts to the changed display parts list, and acquires the display parts 52 by the display parts response.

This secondary response is used, for example, when the device changes the operation screen display to the display that indicates "during rewinding" when the tape reaches the tail end during reproduction of the VTR and rewinding begins automatically, etc. This may be used for changes of the still picture on the operation screen (from convex display to concave display) for the operations such as pressing and releasing of the button on the operation screen.

After the function information table 8 in the controller is updated, the function information table managing means 12 instructs the display/function selection means 14 to update the screen display, and the display/function selection means 14 updates the screen.

In this case, it was stated that the identifier of the changed object is included in the secondary response 121, but when the object entity, for example, the display part is changed, the display parts list and the data object that belongs to this list may be transmitted as the secondary response. In such an event, the display parts request and the display parts response are no longer needed and

processing is able to be simplified.

It is also possible to allow the operation response 251 to have the information that indicates the state change in the device that is generated directly for the operation request 241, and in such an event, the secondary response 121 may be transmitted when changes other than this state change are directly generated. For example, for changes of the still picture on the operation screen (from convex display to concave display) for the operations such as pressing and releasing of the button on the operation screen, etc., a quick response is able to be obtained, and the number of frequencies to carry out the notification request can be reduced, and the traffic of the transmission line 1 can be reduced.

In addition to the requests/responses, etc. shown in the first embodiment, communication may be carried out between the controller and the device, and though it is not illustrated, for example, it may be configured to return the recognition signal for confirming that the other party has received each request and response.

FIG. 6 is a flow chart that shows the controller processing in the first embodiment. In this case, the controller processing of the protocol shown in FIG. 5 is indicated. However, in this case, the operation request 241 and the operation response 251 are omitted.

In the processing 501, the controller sends the notification request to the device, and in the processing 502, the controller waits for the response. In the processing 503, the controller confirms the version information, and if the version information is updated, the controller reads the objects which are required in the processing 504, 505, updates the version information in the processing 506, and displays the version information on the screen in the processing 507. By the way, when the device power supply is turned on for the first time, when the device is connected to the transmission line 1 or when the controller uses the menu information of this device for the first time, it must be configured so as to enable a denial judgment in the processing 503, and the processing that is indicated from the processing 504 to 507 are carried out. Consequently, the case in which the version information happens to coincide with an incorrect version information can be prevented, and the correct version is able to be definitely obtained. When the version information is not updated, since the information on the device function information table coincides

with the information on the controller function information table, reading of the object, updating of the screen, etc. will not take place.

Thereafter, in the processing 508, the controller waits for the secondary response. When the controller receives the secondary response, this means that the version information has been changed, and therefore, the controller reads the object that is changed in the processing 509 by using the identifier of the updated object which is included in the secondary response, updates the version information in the controller in the processing 510, and updates the screen display in the processing 511.

By repeating this processing, the controller is able to constantly grasp the device condition.

In addition, because the device is able to notify the controller of a change of the device state information by the version information, the device is able to change its own state information at any optional time. That is, even during the period from when the controller detects the change of the device state information to when the controller imports this state information, the device is allowed to change its own state information, and the device does not need to use the buffer for temporarily storing the change of the state information, which not only simplifies the processing but also reduces the storage region.

The present invention is not applied only when the function information table that indicates the device function is updated but, as shown in FIG. 7, after the primary response 111 is acquired, the controller sends the information request 131 for the optional information of the device to the device, and receives the information response 141 from the device, and as a result, the controller is able to constantly grasp the information. For example, this is effective to grasp the condition of the monitoring system for monitoring intruders or the device which operates in a remote place by the change of images.

FIG. 8 is an example when this protocol is repeatedly used, and, as shown in FIG. 8, the controller is able to constantly grasp the device condition by successively repeating a series of procedures by the configuration in which the controller automatically transmits the notification request 102 when the controller receives the secondary response 121.

The version information is defined as the version of the device state information, but each of

the menus possesses the version information that indicates the version of each menu, and the same effects are able to be obtained.

As described above, according to the first embodiment, the device possesses the state information that indicates the device state and the version information that indicates the version of the state information, and when the state information is updated, the relevant version information is updated. Further, by reading the state information and the version information from the device, the controller is able to easily detect the device state change and, at the same time, is able to definitely identify the state information in the device without a problem even when the state change inside the device occurs due to the control of other controllers or a spontaneous change inside the device.

The device has the state information that indicates the device condition and the version information that indicates the version of the state information, and the version information is updated when the state information is updated. The controller issues the notification request to the device for requesting the notification on the change if any state information is changed, and the controller receives the version information as the primary response to the notification request. Further, when the state information is changed inside the device, the controller receives the updated version information, and as a result, it is not necessary for the controller to constantly monitor the device by polling, etc., thereby making it possible to simplify the controller processing, and at the same time, since the device that has caused the state change spontaneously notifies the controller of the state change, the controller is able to quickly detect the state change inside the device.

It therefore becomes possible to transmit the updated state information only by including the updated version information and the updated state information (identifier) in the secondary response from the device, and the traffic of the transmission line can be reduced. Furthermore, by including the updated state information (the state information itself), it is not necessary for the controller to read the changed state information after the controller detects the state change, processing of the controller is able to be simplified, and at the same time, on the device side, a problem for enabling the controller to read the state information is eliminated, and the traffic of the transmission line is able to be further reduced.

The device has the operation screen information that indicates the device operation screen and the version information that indicates the version of the operation screen information. The controller reads the operation screen information and the version information from the device, and detects the change of the device operation screen information by the version information, thereby making it possible for the controller to easily detect changes of the device state due to instructions from other controllers or spontaneous changes inside the device, and at the same time, enabling the controller to easily and definitely identify the operation information that correctly reflects the device condition.

The device comprises one or a plurality of objects and has the operation screen information that indicates the device operation screen and the version information that indicates the version of the operation screen information. When the controller displays the operation screen information of the device on the display screen, the controller issues the notification request to the device for requesting the notification on the change if any state information is changed, and the controller receives the version information as the primary response to the notification request. When the state information is changed inside the device, the controller receives the updated version information, and as a result, the controller is no longer necessary to constantly monitor the device by polling, etc., thereby making it possible to simplify the controller processing, and at the same time, since the device that has caused the state change spontaneously notifies the controller of the state change, the controller is able to quickly detect the state change inside the device. Consequently, the controller is able to quickly present the latest operation information to the user and provide a user-friendly interface to the user.

It becomes easy to transmit the updated object information only by including the updated version information and updated object information (identifier) in the secondary response from the device, and the traffic of the transmission line can therefore be reduced. Furthermore, since the updated object information (the object itself) is included, it is not necessary for the controller to read the changed object after the controller detects the operation screen information change, and processing of the controller is able to be simplified. At the same time, on the device side, a problem for enabling the controller to read the state information is eliminated, and the traffic of the

transmission line is able to be further reduced. Consequently, the controller is able to quickly present the screen update to the user and the improved operability and visibility of the operation screen are achieved.

Because the version information is the counter value that is incremented each time the information inside the device is updated, the reliable version information is able to be created by a simple configuration and simple processing.

Second Embodiment

With reference to FIG. 9 through FIG. 14, the second embodiment of the present invention will now be described. In this case, the configurations of the device and the controller are the same as those of the first embodiment shown in FIG. 1 and FIG. 2 and their explanation will be omitted.

FIG. 9 shows the configuration of the function information table 8 of the second embodiment, and since the configuration of the device information parts 50 is the same as that of the first embodiment shown in FIG. 4, the device information parts 50 is not illustrated in FIG. 9. Numeral 60 denotes a menu set indicating a set of function menus in the device, numeral 61 denotes the main function menu that indicates the main menu of the device, numeral 62 denotes the first sub function menu that indicates the first submenu of the device, and numeral 63 denotes the second sub function menu that indicates the second submenu of the device. In this event, the menu set list 60 has identifiers of function menus that show the main menu 61 and each sub menu 62, 63, and each function menu 61, 62, 63 are able to be detected by tracing the link from the menu set list 60.

Each part comprises objects of the list form, and the data object which does not have a child object (text object, still picture object, etc.) and the list are generically referred to as the object. That is, as the object information, there are a data object, a list, various header information, and unique information. By the way, it is not necessary each object to take a list structure, but may be configured only by the data object, or by the unique information and the data object, which is the same as in the case of the first embodiment.

Each object has an identifier (ID) that identifies the object, type information that indicates the type of the object, attribute information that indicates the configuration such as whether or not the object has a child object, etc., and size information that indicates the size of the object, etc. in the header section. In addition, each object indicates the child object by the ID information in the entry that is mentioned in the list.

The objects such as text objects, etc. which have a small data amount may have the object itself stated in the entry section in the list. In addition, the unique information of each list should be stated in the header, etc. in each list, and the unique information of the data object should be stated in the entry. Furthermore, the unique information may be stated either in the object or in the entry.

The identifier (ID) of the menu set list in the menu set 60 is contained in the device information parts list 50.

The device information list 50 may contain the identifier of the function menu that indicates the main menu 61, and in such an event, each of the sub menus 62, 63 is able to be detected by tracing the link from the main menu.

The menu set 60 collects function menus inside the device, and the number and the size of the menus existing in this device are stated as unique information in the header inside the menu set list in the menu set 60.

The menu set list 60 has the entry of all of the function menus that belong to the menu set. In this entry, for example, the identifier of each function menu is entered, and flags that show the type of relevant function menus are also entered. There are generally a main menu and sub menu for the type of function menus. For this sub menu, for example, there are an operation menu that indicates part of the functions inside the device, a help menu that indicates the usage, a contents menu that collects contents information only inside the device, an editing menu for carrying out an editing operation, a setting menu for setting the device, etc.

In the second embodiment, each menu is identified by the use of a flag, but it may be configured so as to distinguish each menu by stating the main menu only in the top entry of the menu set list or stating in the apparatus configuration information 7, etc., or to acquire information

on each sub menu by tracing successively from the function menu list of the main menu. It is also possible to enable direct access to each function menu list by the method such as predetermining an ID of each function menu list without tracing from the entry of menu set.

The main function menu 61 shows the main menu of the device, which comprises function menu lists, which are sets of display parts 52 indicating the main function of the device. The function menu list is able to be linked from the entry inside the device information list 50, and has the operation screen and the entry of display parts 52 for indicting the list itself. The configuration of the display parts list 52 is the same as that in the first embodiment shown in FIG. 4.

The main function list 61 has the information for configuring the operation screen, and has the screen size that is assumed by the main menu and the information on the background color and background pattern, etc. in the header, etc. as unique information. That is, in FIG. 9, it is stated as the text object, but the data object (text, still picture, etc.) of the display parts that indicate the function menu list itself in the main function menu 61 has a direct entry in the function menu list.

The display parts list may be used for the data object that shows the list itself. The information that indicates these lists themselves may be distinguished from other data objects and display parts 52 by using flags, etc.

In the function menu that indicates the main function menu 61, display parts that show the link to each sub menu are included. This display part is a still picture or text data and shows the sub menu of the reference, and when the user chooses this display part on the controller, the reference sub-menu is displayed on the screen.

Similarly, the first sub function menu 62 indicates the first sub menu of the device and the set of display parts 52 that indicate the sub functions of the device, and comprises the function menu list. The function menu list is linked from the entry in the device information list 50, and has entries for the operation screen and of display parts 52 for indicting the list itself. The configuration of the display parts list 52 is the same as that of the first embodiment shown in FIG. 4.

The function menu list in the sub function menu 62 has the information for configuring the

operation screen of the apparatus, and has the screen size that is assumed by the sub menu and information such as background colors, background patterns, etc. in the header as unique information.

In FIG. 9, although it is stated as a text object, the data object (text, still picture, etc.) of the display parts that indicate the function menu list itself in the first sub function menu 62 has a direct entry to the function menu list.

By the way, for the data object that indicates the list itself, the display parts list may be used. In addition, the information that shows these list themselves may be distinguished from other data objects and display parts 52 by using flags, etc.

Inside the function menu that indicates the sub function menu 62, display parts that indicate the main menu of the returning place or link to the sub menu are contained. This display part is a still picture or text data and shows the menu of the returning place, and when the user chooses this display part on the controller, the menu of the returning place is displayed on the screen and the focus is moved. When the menu is displayed together with the sub menu on the controller screen, the focus only may be simply moved.

The second function menu 63 is the same as the first sub function menu 62.

FIG. 10 shows a configuration example of the menu of the second embodiment. In this case, the device illustrates the case with three menus. Menu 300 is the main menu of this device, while menu 310 and menu 320 are sub menus which are linked from the menu 300 and which indicate each of the sub function menus 62 and 63. That is, if the user selects the display part 303 in the menu 300 when the menu 300 is displayed on the controller display screen, the first sub menu 310 is displayed on the controller screen, and similarly, when the display part 304 is chosen, the second sub menu 320 is displayed. If the display part 313 is chosen when the menu 310 is displayed, the main menu 300 is displayed.

Display parts 311, 312,321, 322 show the functions or states of this device, and for example, if the menu 310 indicates the function or the state of the VTR deck section, the display part 311 is a reproduction button and the display part 312 is a stop button, etc. If the menu 320 shows the function or state of the VTR tuner section, the display part 321 is a channel UP button and the

display part 322 is a channel DOWN button, etc. Furthermore, for example, when the menu 300 indicates the VTR, the display part 301 is a voice change-over button and the display part 302 is an input change-over button, etc.

FIG. 11 is an illustration of the network control system of the second embodiment, and with reference to FIG. 11, the control action of the controller and the device will be explained. The main points that differ from the control action of the first embodiment shown in FIG. 5 are that in the notification request 101, the information on the notification range that shows the range the controller hopes to bring the information in coincidence with the device is included and when the secondary response 121 is received, a new notification request and the primary response are transmitted and received in succession.

First of all, when the device is connected to the transmission line 1, the controller on this transmission line 1 recognizes the new device by bus resetting, etc., reads the device information part 50 from the new device through the transmission line 1, and reads and registers this device information part 50 to the function information table 8 of the function database 13 of the controller.

The physical/logical configuration of the function information table 8 in the controller is not always the same as that of the function information table 8 inside the device, but at least, the information which the controller needs at this present moment should be same as that in the device.

That is, each part in the function table 8 does not have a physical link (relation between entry and the actual substance) as shown in FIG. 9, and may allow access from the controller object by object.

The display/function selection means 14 in the controller refers to the function information table 8 or part of the function information table 8 in the function database 13 through the function information table managing means 12.

When the display/function selection means 14 displays a table to devices that are connected to this controller, the display/function selection means 14 uses the function information table managing means 12 to read the data objects (text objects, still picture objects, etc.) that belong to the device information parts 50 from the function information table of all the devices which are registered to the function database 13, and displays these on the screen.

display part 322 is a channel DOWN button, etc. Furthermore, for example, when the menu 300 indicates the VTR, the display part 301 is a voice change-over button and the display part 302 is an input change-over button, etc.

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First of all, when the device is connected to the transmission line 1, the controller on this transmission line 1 recognizes the new device by bus resetting, etc., reads the device information part 50 from the new device through the transmission line 1, and reads and registers this device information part 50 to the function information table 8 of the function database 13 of the controller.

The physical/logical configuration of the function information table 8 in the controller is not always the same as that of the function information table 8 inside the device, but at least, the information which the controller needs at this present moment should be same as that in the device.

That is, each part in the function table 8 does not have a physical link (relation between entry and the actual substance) as shown in FIG. 9, and may allow access from the controller object by object.

The display/function selection means 14 in the controller refers to the function information table 8 or part of the function information table 8 in the function database 13 through the function information table managing means 12.

When the display/function selection means 14 displays a table to devices that are connected to this controller, the display/function selection means 14 uses the function information table managing means 12 to read the data objects (text objects, still picture objects, etc.) that belong to the device information parts 50 from the function information table of all the devices which are registered to the function database 13, and displays these on the screen.

Then, when the user selects, for example, the device still picture object (a still picture that belongs to the device information part 50) by using the pointing function (for example, crosshair key), etc. of the remote controller, the display/function selection means 14 issues a request for the main menu to the function table managing means 12, and the function information table managing means 12 reads the function menu 61 that shows the main menu of this device and the display parts that belong to this function menu 61, and stores them in the function information table 8 in the controller.

In such an event, first of all, the controller transmits the notification request 101 shown in FIG. 11 to the device as a command. As a response to this, the device returns the primary response 111, and in this primary response 111, the version information of the function information table 8 that indicates the function of the device is contained.

In addition, in this notification request 101, the information on the notification range that indicates the range the controller hopes to bring the information to coincide with the device is included, and as the response, the device returns the primary response 111. In this primary response 111, the version information corresponding to the notification range is included. This notification is specified by the framework such as a device unit including the whole function information table or component unit (for example, function menu), etc. or menu unit, etc. For example, when the device unit of the whole function information table is specified as the notification range, the device notifies the controller of the change as the secondary response to the notification request when the object either in menu 300, menu 310 or menu 320 is changed.

On the other hand, when the information that indicates the menu unit and the main menu is chosen, the device notifies the controller of the change only when the object in the menu 300 that is located in the main menu inside the device, and does not notify the controller of the change when the object in the sub menu 310 or the sub menu 320 is changed.

When the menu unit and menu 310 (specified with ID of the function menu) are specified for the notification range, the device notifies the controller of the change of the object in the menu 310 only. That is, when the information change is requested to the main menu of the device, for the information of this notification range, the information indicating the menu unit and the main menu

(not limited to the identification of the function menu, which is the main menu) are transmitted.

If the controller specifies a specific function menu as the notification range, the device notifies the identifier (ID) of the specific function menu to the controller as the secondary response when the object that belongs to the specific function menu (list and data object) is changed. For example, when the controller simultaneously displays menus 300, 310, 320 on the screen or caches all the device information, the notification range is designated to the device unit of the whole function information table and when it is displayed menu by menu, the notification range is designated to the menu unit (component unit).

In this case, the notification range is explained as the information which the controller displays, but what is specified as the notification range should not always be limited to what the controller displays and instead may be the unit of the information which the controller possesses. In such an event, by the controller's caching of the information outside the display range, the menu is able to be quickly changed over on the display screen. Furthermore, the notification range should not be limited to the display element but may be applied to optional information such as device state information etc. that is indicated in the bit string.

The version information is updated (incremented) when the information inside the device is changed. Consequently, the information other than the notification range is changed, and the version information of the function information table is updated. The version information is also updated when the component set parts, etc., which are sets of the function menu in the notification range and the display parts 52, and the display parts 52 located below are changed. The version information may be configured in such a manner so as to indicate the version of the whole device including the device information and function menu 51 and the display parts 52 located below.

When the whole function list is indicated as the notification range, the identifier (ID) of the main function menu 61, which is the main inside the device, may be returned as the primary response 111, and in such an event, the device is enable to easily change its main menu. Furthermore, for example, it may be configured to return the identifier (ID) of the main function menu 61 as the primary response when the controller specifies the information that indicates the menu unit and main menu and sends the notification request to the device.

It is also possible to return the menu set list of the menu set 60 as the primary response 111, and in such an event, the controller recognizes the meaning of each function menu (main menu, sub menu, help menu) by the flags that are mentioned in the menu set list, and specifies the desired function menu by the identifier of the function menu that is stated in the menu set list. In this case, for example, the first entry of the menu list may be specified as the main menu, and the main menu may be judged in order of the entries to each function menu.

When the menu to be displayed is changed by operations, etc. of the user, the controller is able to make the notification request of the change in the device information to the menu newly displayed by specifying the new notification range when the notification request is issued, and the controller is able to efficiently acquire the state change information with a simple configuration (that is, with a small storage area). This is not limited to the menu but is applicable in the same manner to each component.

In order to acquire the contents of the function menu that corresponds to the notification range, the function information table managing means 12 in the controller transmits the menu request 201 to the device, and the device returns the list of identifiers (ID) of the display parts that belong to the function menu 61 as the menu list response 211, which is the response to this menu request 201.

The function information table managing means 12 sends a display parts request 221 to the device with the identifier of the display parts attached thereto in order to acquire the entity of each display part, and acquires each display part with the display part response 231, which is the response to this display parts request 221. In this event, the display parts may read those that belong to the intended function menu as a whole or one by one. In addition, as a response to the menu request 201, all of the display parts that belong to the function menu may be transmitted. When the display parts are read, the display parts list 52 and the data object (text object, still picture object, etc.) may be accessed separately and read.

In this way, the information in the notification range of the device function information table 8 is read by the function information table managing means 12.

Consequently, the display/function selection means 14 reads the display parts from the

function information list of each function that is mentioned in the function menu list from the device function information table 8 by using the function information table managing means 12, and displays the display parts corresponding to each function on the screen. Accordingly, on the screen, it becomes possible to display the display parts that show all the functions of this device.

In this case, the identification of each display part is carried out by the unique ID of the device and the ID of each of the display parts.

When, when the user selects the display parts 52 that show, for example, reproducing functions of the device by using the pointing functions, etc. of the remote controller, the display/function selection means 14 transmits, to the device, the identifier (ID) of the display parts 52 that are designated by the device as the control code together with the user operation information (for example, "selection"). That is, even when the cursor, with the crosshair that indicates the top and bottom and right and left of the remote controller, is moved on this display part and the selector button is pressed and then released, the ID of this display part 52 (control code) and the user operating information ("selection") are transmitted to the device as the operation request 241.

As responses to the operation request, in the operation response 251, responses such as whether or not the operation request 241 is received, rejected, not supported by the device are returned.

Then, when the state in the device changes and the objects (function menu list, display parts list, data object) in the device change, the device returns the secondary response 121 to the notification request 102. In this secondary response 121, the incremented version information and identifiers (ID) of objects changed are included.

Although in this case, it is stated that the identifiers of objects which are changed are included, it may be stated that when a plurality of display parts 52 that are included in the function menu change, the identifiers of the function menu are returned. Furthermore, it may also be stated that the identifiers of objects which are changed are returned as the secondary response in the same manner as when the objects that belong to the device information parts 50 change.

The function information table managing means 12 detects that objects in the device have

changed by receiving this secondary response, and by using the identifier of the changed object, requests the changed object. Before the function information table managing means 12 request the changed object, the secondary notification request 102 is sent to the device. For this response, the primary response 112 is obtained. In this primary response 112, the version information of the device is included.

First of all, when the version information that is contained in the primary response 112 of the notification request 102 is the same at the version information of the secondary response 121, since the device state is not changed between the secondary response 121 and the notification request 102, the difference between the controller information and the device information is the object which is notified by the secondary response 121. Consequently, this object is requested by the object request 262 and the object which is changed by the object response 272, which is the response to this object request 262, is obtained. For example, if the changed object is the function menu the identifier of the function menu list is notified in the secondary response 121), the menu request is carried out as this object request, and for the object response, the menu list response is obtained, and the function menu list is acquired. Further, the controller checks the display parts list changed in the function menu list, requests display parts to the changed display parts list, and acquires the data object of the display parts 52 by the display parts response.

On the other hand, when the version information of the primary response 112 differs from the version information of the secondary response 121, the difference between the controller information and the device information is not definite. That is, because the version information which is incremented each time the information inside the device changes differs, the information in the device is changed between the secondary response 121 and the primary response 112. Consequently, in this event, the controller first reads the list (function menu list, display parts list, etc.) only of the objects in the notification range that is held by the controller in the object request 262. Further, the controller judges whether the identifier (ID) of each object that is stated in this list coincides with the identifier (ID) of the objects in the information that is held in the controller, and sends the objects with a difference only to the device as the object request (not illustrated in FIG. 11) and obtains them in the object response (not illustrated in FIG. 11).

Consequently, it becomes possible to bring the information that the controller holds to coincide with the information of the device even when the data object only is changed or the list itself is changed. Consequently, it is no longer necessary to use the information of the updated object which is acquired in the secondary response 121. Thereafter, the controller updates the version information of the function information table 8 in the controller.

In this way, by constantly making the notification request before the controller acquires the device information, the time the controller does not make the notification request to the device can be reduced and the device change can be quickly and definitely acquired.

After the function information table 8 in the controller is updated, the function table managing means 12 instructs the display/function selection means 14 to update the screen display, and the display/function selection means 14 updates the screen.

In addition to the requests/responses, etc. which are shown in the second embodiment, communication may be carried out between the controller and the device, and although it is not illustrated, for example, it may be configured to return the recognition signal for confirming that the other party has received each request and response.

FIG. 12 is a flow chart that shows the controller processing in the second embodiment. In this case, the controller processing of the protocol shown in FIG. 11 is indicated. However, in this case, the operation request 241 and the operation response 251 are omitted.

First of all, when a device is connected to the transmission line 1, in the processing 501, the controller sends the notification request to the device, and in the processing 502, the controller waits for the response. By the way, in such an event, if the device is not connected to the transmission line 1, for example, a still picture that indicates this device is chosen, the controller displays the menu screen of this device, and the controller may send the notification request to the device. Alternatively, the controller may send the notification request when the controller acquires the control right of the device or the controller begins to accumulate the device information.

In the processing 504, 505, the controller reads the objects which are required in processing. When the required object is properly read, the controller stores the version

information in the processing 506, and displays the version information on the screen in the processing 507.

Thereafter, in the processing 508, the controller waits for the secondary response and because receiving the secondary response means that the version information has been changed, the controller temporarily stores the version information that is contained in the secondary response in the processing 515 after the secondary response is received, and stores the update information (identifier of the object updated) that is contained in the secondary response in processing 520.

Then, the controller gives the notification request to the device in the processing 521 before the controller reads the object which is shown in the update information, and waits for the primary response to the notification request in the processing 522. After the controller receives the primary response, the controller judges whether the version information that is obtained in the primary response is the same as the version information which is temporarily stored in the processing 515, and if the version information is the same, by using the updated information which is stored in the processing 520, the controller reads the updated object in the processing 524.

On the other hand, when the version information that is obtained from the primary response differs from the version information which is temporarily stored in the processing 515, the controller overwrites the version information that is obtained from the primary response in the processing 525 on the version information that is temporarily stored in processing 515 and temporarily stores the updated version information, reads the list in the notified range in the processing 526 from the device, checks whether it is same as that inside the controller, and reads objects from the device in processing the 527 for only those that are different.

In the processing 528, the controller updates the temporarily stored version information as the new version information, and displays the updated information on the controller screen in the processing 529. That is, because the version information is updated after the updated information is read, the reliability of the version information that the controller possesses is improved.

Next, in the processing 530, the controller judges whether or not the notification request to the device is stopped, and if the notification request is continued, the controller repeatedly executes the processing 508 to the processing 530.

When the notification range is changed, for example, from the whole function information table to the specific component element (menu, etc.), the processing is terminated in the processing 530 and resumed in the processing 501.

Consequently, by repeating this processing, it becomes possible for the controller to quickly and accurately grasp the device state. That is, because the controller is able to hold the state of issuing the notification request, the device is able to immediately notify the controller of any changes when the device state is changed in any case, and it becomes possible to bring the state information of the device that the controller holds to coincide with the state information in the device.

In the second embodiment, for the secondary response, the identifier (ID) of the updated object is transmitted together with the version information, but as shown in FIG. 13 and FIG. 14, for the secondary response, the updated object itself may be transmitted together with the version information.

FIG. 13 is a protocol illustration of the network control system when the object itself updated as the secondary response is transmitted, FIG. 14 is a flow chart showing the controller processing when the updated object is transmitted as the secondary response, and with an exception in that the processing 524 (FIG. 12) for reading the updated object is omitted, the control operation shown in FIG. 11 and FIG. 12 is the same, and the description thereof is omitted here. Consequently, in the example shown in FIG. 13 and FIG. 14, as compared to FIG. 11 and FIG. 12, it is no longer necessary to acquire the updated objects after the secondary response is received, and therefore, the processing can be simplified.

As described above, according to the second embodiment, the device possesses the state information that indicates the device state and the version information that indicates the version of the state information which is updated when the state information is updated. Further, the controller issues the notification request for requesting the notification of a change of the state information to the device when the controller uses the device state information, and receives the version information as the primary response to the notification request. When the state information is changed in the device, the controller receives the updated version information as the

secondary response to the notification request, and the controller reads the state information between the primary response and the secondary response. By doing so, even when any change occurs in the state in the device while the controller is reading the state information, the controller is able to immediately detect the state change in the secondary response, and is able to know the state change of the device quickly and accurately.

In addition, by issuing the notification request before the controller reads the state information of the device, the controller is able to hold the condition of being able to constantly issue the notification request to the device. Moreover, even if the device state is changed in any case, the device is able to notify the controller of the change immediately, and the state information of the device that the controller holds is able to be brought to coincide with the state information inside the device.

It therefore becomes possible to transmit the updated state information only by including the updated version information and the updated state information (identifier) in the secondary response from the device, and the traffic of the transmission line can thereby be reduced. Furthermore, by including the updated state information (state information itself), since it is no longer necessary for the controller to read the changed state information after the controller detects the state change, processing of the controller is able to be simplified, and, at the same time, on the device side, a problem of enabling the controller to read the state information is eliminated. Accordingly, the traffic of the transmission line is able to be further reduced.

The effects of the second embodiment are the same as those described in the first embodiment.

Third Embodiment

With reference to FIG. 15 through FIG. 18, the third embodiment according to the present invention will now be described. The configuration and the operation of the device and the controller are partly modified from the second embodiment, and the main differences of the configuration example of the third embodiment shown in FIG. 15 from that of the second embodiment shown in FIG. 9 are that the menu set list 60 has a function table version information,

the function menu lists 61, 62, 63 have the element version information, respectively, and these pieces of version information are created by the version information generating means 18. All other configurations and operations of the third embodiment are the same as those of the second embodiment, and explanation of those configurations and operations overlapping with the second embodiment will be omitted here.

FIG. 15 shows a configuration example of the function information table 8 of the third embodiment, FIG. 16 shows a configuration example of the version information creating means 18, FIG. 17 shows the operation flow of the version information creating means 18, and FIG. 18 is an illustration that shows how the version information changes.

In the third embodiment, the function information table 8 is a table of the information (operation screen information) for configuring the operation screen, and in this function table 8, objects which are necessary for configuring the operating screen of the device, and an identifier (ID) for identifying this object, etc. are included. This object is the component, and examples of the object include the function menu, display parts, text parts, text data objects, still picture data objects, etc.

In addition, the information that indicates the device condition is the information that contains the contents information and operation state information. Furthermore, for example, as in the case of the VTR reproduction button, the information contains the condition of each display part such as the still picture with the button held depressed, the still picture with the button released, etc.

The function information managing means 17 in the device processes the information in the notification range that is contained in the notification request from the controller. The notification range is the range for which the device notifies the change when the state or function inside the device changes, and the range the controller desires is specified as the notification range. For the notification range, the whole function information table 8 (all of the information that is contained in the function table 8) and components of the function table 8 (function menu unit, display part unit, etc.) can be specified. Consequently, the function information managing means 17 acquires the information in the notification range from the notification request that is issued from the controller

and notifies the controller of the change of the notification range only when the state or function in the device changes. When a plurality of controllers exist, the function information control means 17 notifies the controller in whose notification range, the changed condition or function is included in conformity with the notification range of each controller. In this case, for the notification range, the whole function table and components only are designated, but for example, it is possible to designate the whole device (including the whole function table and the device information), and the similar effects are able to be obtained.

By providing the notification range in this way, it is possible to prevent the controller from being notified about data of the device which the controller does not presently desire, because if the controller does not need such information, there is no need to process these data, and therefore, the processing efficiency can be increased.

The version information creating means 18 of the device carries out version control, such as the frequency of occurrences of information state changes in the function information table 8, and is formed with counters, etc. The counter value in the version information creating means 18 is incremented by the function information control means 17 for each time the information is mentioned in the RAM16 in the function information table 8.

The version information that is shown by this counter value, etc. are classified by the function table version information that indicates the version of the function table 8 and the element version information that indicates the version of the components (function menu, display parts, data object, etc.) in the function table 8, and these pieces of version information are created by the version information creating means 18.

When a notification request is issued from this controller to the device with respect to changes of the state in the device (for example, changes of information of the function table 8), these pieces of version information are included in the primary response or the secondary response to the notification request in accordance with the notification range. The device may be configured to give a plurality (3 or more) of responses to one notification response, as well as to include the version information at that point in each response in accordance with the notification range, and in such event, the state change of the device is able to be definitely recognized and, at

the same time, the traffic on the transmission line 1 can thereby be reduced.

When the information of the function information table 8 of the new device and this version information are read in the controller, the controller registers this function information table 8 to the function database 13 and, at the same time, stores the version information of the function information table 8 in relation to the function information table 8. In such an event, the version information may be stored in the memory together with the function information table 8 in the function database 13, or the function information table control means 12 may store and control the version information. When the components in the function information table 8 are read together with the element version information, the controller stores the components in the function information table 8 in relation to the element version information. The element version information may be stored by the function information table control means 12, etc. and may be controlled.

FIG. 15 shows the configuration of the function information table 8 of the third embodiment, and since the device information parts 50 have the same configuration as that of the first embodiment, the device information part 50 are not illustrated in FIG. 15. Numeral 60 denotes a menu set indicating a set of function menus in the device, numeral 61 denotes the main function menu that indicates the main menu of the device, numeral 62 denotes the first sub function menu that indicates the first submenu of the device, and numeral 63 denotes the second sub function menu that indicates the second submenu of the device. These main function menu, sub function menu, display parts, data objects, etc. are components of the function information table 8. In this event, the menu set list 60 has identifiers of function menus that show the main menu 61 and each sub menu 62, 63, and each function menu 61, 62, 63 is able to be detected by tracing the link from the menu set list 60.

The menu set 60 collects function menus inside the device, and the number and the size of the menus existing in this device are stated as unique information in the header inside the menu set list in the menu set. The location of this menu list is recorded in the apparatus configuring information 7. The menu set list may be defined in advance so that all the devices have this menu set 60 and the controller may be intended to acquire the menu set information by using the

command to request this menu set.

In addition, the menu set list has the function table version information. In this event, the function table version information may be stated in the header of the menu set list.

The menu set list 60 has the entry of all of the function menus that belong to the menu set. In this entry, for example, the identifier of each function menu is entered, and flags that show the type of relevant function menus are also entered. For the type of function menus, there are generally a main menu and sub menu. For this sub menu, for example, there are an operation menu that indicates part of functions inside the device, a help menu that indicates the usage, a contents menu that collects contents information only inside the device, an editing menu for carrying out an editing operation, and a setting menu for setting the device, etc.

In the third embodiment, each menu is identified by the use of a flag, but it may be configured so as to distinguish each menu by stating the main menu only in the top entry of the menu set list or by stating in the apparatus configuration information 7, etc., or to acquire information on each sub menu by tracing successively from the function menu list of the main menu. It is also possible to enable direct access to each function menu list by the method such as predetermining an ID of each function menu list without tracing from the entry of menu set.

The main function menu 61 shows the main menu of the device, which comprises function menu lists, which are sets of display parts indicating the main function of the device. The function menu list is able to be linked from the entry inside the device information list, and has the operation screen and the entry of display parts for indicting the list itself. The configuration of the display parts list is same as that in the first embodiment shown in FIG. 4.

In addition, the main function menu 61 has the element version information that indicates its own version. This element version information is updated when any of the components which have the entry in the main function menu 61 is changed.

When the main function menu 61 has configuration set parts comprising a plurality of display parts 52, the element version information of the main function menu 61 is updated when the display part 52 in the configuration set parts is changed.

The data object is arranged to the display parts list that shows this display parts entry. In

this event, the direct entry of each display part 52 may be arranged in the function menu list without using the display parts list, and in such an event, flags, etc. for indicating objects may be noted in the entry of each display part 52.

In addition, the function menu list has the information for configuring the operation screen of the apparatus and has the information such as the screen size which the function information table 8 assumes, as well as background colors, background patterns, etc. as unique information in the header, etc.

In addition, the data objects (texts, still pictures, etc.) showing this function menu list itself have a direct entry in the function menu list.

The main function list 61 has the information for configuring the operation screen, and has the screen size that is assumed by the main menu, and the information on the background color and background pattern, etc. in the header, etc. as unique information. That is, in FIG. 15, it is stated as the text object, but the data object (text, still picture, etc.) of the display parts that indicate the function menu list itself in the main function menu 61 has an direct entry in the function menu list.

The display parts list may be used the data object that shows the list itself. The information that indicates these lists themselves may be distinguished from other data objects and display parts 52 by using flags, etc.

In the function menu that indicates the main function menu 61, display parts that show the link to each sub menu are included. This display part is a still picture or text data and shows the sub menu of the reference, and when the user chooses this display part on the controller, the reference sub-menu is displayed on the screen.

Similarly, the first sub function menu 62 indicates the first sub menu of the device and the set of display parts 52 that indicate the sub functions of the device, and comprises the function menu list. The function menu list is linked from the entry in the device information list, and has entries for the operation screen and of the display parts 52 for indicting the list itself. The configuration of the display parts list 52 is the same as that of the first embodiment, and is the display element that shows the device function and state and one of the components of the function information table 8.

It is also possible to configure the display part 52 to have the element version information, and in such an event, with the display part as a unit, the controller is able to directly recognize the display part being changed in the device, and therefore, the transmission and processing can be simplified.

The sub function menu 62 has the element version information that indicates its own version. This element version information is updated when any of the components which have the entry in the sub function menu 62 is changed.

By the way, when the sub function menu 62 has configuration set parts comprising a plurality of display parts 52, the element version information of the sub function menu 62 is updated when the display part 52 of this configuration set parts is changed.

The function menu list in the sub function menu 62 has the information for configuring the operation screen of the apparatus, and has the screen size that is assumed by the sub menu and information such as background colors, background patterns, etc. in the header as unique information.

The second function menu 63 is the same as the first sub function menu 62.

The menu and the configuration of the display part is the same as that of the second embodiment shown in FIG. 10.

In the version information generating means 18 shown in FIG. 16, the function table version information generating section 81 carries out version management of the information in the function information table 8, and is configured by the use of counters, etc. Each time the information stated in the function information table 8 is changed by the function information managing means 17, the component updating information is obtained from the function information managing means 17 and the counter reading in the function table version information generating means 81 is incremented. This counter is an endless cyclic counter of a finite bit length with a sufficient bit length, and when the maximum value of the counter is incremented, the value of the counter becomes the minimum value. The counter bit length is optional but it is desirable for the device to have a sufficient bit length so that the counter value does not make a circuit at least within the time while the controller has a control right or subscribing right of state

change in order to prevent the different function information table 8 from being presented at the same counter value.

The updated component judging section 82 detects which component that corresponds to a plurality of component version information holding sections (91, 92, 93, ...) is changed by using the component updating information which is obtained from the function information managing means 17, and stores the updated function table version information in the component version information holding section of the applicable component.

The first component version information holding section 91 holds, for example, the main function menu 61 shown in FIG. 15, that is, the element version information of the menu 300, and this value becomes the element version information in the function menu 61.

The second component version information holding section 92 holds, for example, the first sub function menu 62 shown in FIG. 15, that is, the element version information of the menu 310, and this value becomes the element version information in the first sub function menu 62.

The third component version information holding section 93 holds, for example, the second sub function menu 63 shown in FIG. 15, that is, the element version information of the menu 320, and this value becomes the element version information in the second sub function menu 63.

In such an event, when the display part 312 in the menu 310 shown in FIG. 10 changes, the function table version information generating section 81 receives the component element updating information for which the display part 312 is changed from the function information managing means 17, increments the counter of the function table version information generating section 81, and updates the function table version information. The updated component element judging section 82 detects that the changed display part 312 belongs to the menu 310 by the component updating information and substitutes the function table version information for the second component version information holding section 92 that holds the element version information of the menu 310. Consequently, the element version information of the menu 310 becomes the updated function table version information and is updated.

FIG. 17 shows the operation flow of the version information generating means 18. First of all, in the processing 701, the function table version information and each piece of element version

information are initialized, for example, by becoming zero.

The processing 702 is a step for waiting for changes of the information of the function information table, and when the information is changed, the function table version information is incremented in the processing 703. This processing is carried out by the function table version information generating section 81.

In the processing 704, the component whose information is changed is detected, and the function table version information is substituted for the element version information of this component. This processing is carried out by the updated component judging section 82.

The processing 705 judges the completion of these series of processing, and for example, when the power supply of this device is turned on, these series of processing are repeated.

FIG. 18 is an illustration that shows the condition of changes of the version information, and in this case, the first component shows, for example, the menu 300, the second component the menu 310, and the third component the menu 320.

In the initial stage, all the version information is cleared to zero. In this event, when the information in the second component is changed, the function table and the second component element version information becomes 1.

Then, when the information in the third component is changed, the function table and the third component element version information becomes 2. In such an event, the element version information of the second component is held at 1 as it is.

When the information in the second component is thereafter changed, the function table and element version information of the second component becomes 3. That is, 2 did not exist in the element version information of the second component.

In the same manner, even when the first component, the second component, and the third component are changed, the function table version information and the element version information of the component including the changed information are updated.

The system control operation of the third embodiment is the same as the operation of the second embodiment shown in FIG. 11 and FIG. 12, and the explanation thereof is omitted here.

However, when this device is first accessed, the device is specified for the notification range,

and as a response to this, the device returns the primary response 111. In this primary response 111, the function table version information (or element version information) of the function table 8 that indicates the device function and state is included.

The function table version information is updated (incremented) when the information inside the device is changed. Consequently, the information other than the notification range is changed, and the function table version information of the function information table is updated. The version information is also updated when the component set parts, etc., which are sets of the function menu in the notification range and the display parts 52, and display parts 52 located below are changed. The function table version information may be configured in such a manner so as to indicate the version of the whole device including the device information and function menu 51 and the display parts 52 located below.

When the whole function list is indicated as the notification range, the identifier (ID) of the main function menu 61, which is the main inside the device, may be returned as the primary response 111, and in such an event, the device is able to easily change its main menu. Furthermore, for example, it may be configured to return the identifier (ID) of the main function menu 61 as the primary response when the controller specifies the information that indicates the menu unit and main menu and sends the notification request to the device. It is also possible to return the menu set list of the menu set 60 as the primary response 111, and in such an event, the controller recognizes the meaning of each function menu (main menu, sub menu, help menu) by the flags that are mentioned in the menu set list, and specifies the desired function menu by the identifier of the function menu that is stated in the menu set list. In this case, for example, the first entry of the menu list may be specified as the main menu and the main menu may be judged in order of the entries to each function menu.

When the menu to be displayed is changed by operations, etc. of the user, the controller is able to make the notification request of the change in the device information to the menu newly displayed by specifying the new notification range when the notification request is issued, and the controller is able to efficiently acquire the state change information with a simple configuration (that is, with small storage area). This is not limited to the menu but is applicable in the same

manner to each component.

The operation after the succeeding operation of the menu request 201 is the same as that of the second embodiment, and the explanation thereof is omitted.

In the third embodiment, the version information generating means is composed by the function table version information generating section, updated component judgment section, and component version information holding section of each component, but the version information generating means may be formed by the use of the function table version generating section and the component version information generating section equipped with a counter which is incremented when the information that belongs to the component is changed. In such an event, each element version information is incremented every time the information in each component is changed, and takes the continuous value for each component. Some element version information is independent from the function table version information or other element version information. Consequently, in such an event, if there are many components with version information, processing of the devices becomes somewhat complicated, but by confirming the element version information, the frequency in which the state is changed in the component is able to be recognized in addition to the similar effects of the embodiment, and in particular, when the element version information which is obtained in the secondary response differs from the element version information of the primary response after this secondary response, it is able to identify how many times the information has been changed during this period.

In the third embodiment, the primary response contains the version information, but the primary response may be configured to contain identifiers of objects which have been changed from the secondary response immediately prior to the primary response together with the version information in the primary response. In such an event, even when the version information of the secondary response differs from that of the primary response thereafter, the controller is able to easily identify objects which have been changed between the secondary response and the primary response, and there is no need to search for changed objects by the list, etc., thereby making it possible to achieve simplified processing.

As described above, according to the third embodiment, since the device has a function table

that indicates the device and state, components that compose the function table, and element version information that shows the version of components of the function table, and since the controller uses the element version information to detect changes of information in the function table when the information in the function table is used, even when the function and the state are changed inside the device due to controls from other controllers or a spontaneous change inside the device, the controller can easily detect the change, and at the same time, the controller can definitely identify the state information in the device without any problems. Furthermore, since the device has version information component by component, the controller is able to meticulously grasp device function and state and at the same time, and since the changes of the component are able to be directly detected, it is easy to acquire the information of the changed component when the changed information is acquired, thereby making it possible to simplify the controller processing and to improve the processing efficiency. Furthermore, since the changed component is directly accessed by the controller, increased efficiency is also achieved for the device.

Since the device has a function table that indicates the device function and state, components that compose the function table, and element version information that shows the version of components, and since the controller uses the function table version information to detect changes of the information in the function table and uses element version information to detect changes of information in the components when the component information in the function table is used, when the controller displays all the information of the function table or only one menu, etc., the device is able to notify the information that is changed which the controller desires in accordance with the request of the controller, and the controller is able to accurately grasp the device information and, at the same time, highly efficient processing with less waste in the transmission line and processing can be achieved.

Since the device has a function table that indicates the device function and state, a plurality of components that compose the function table, and element version information that shows the version of components for each component, and since the controller uses the element version information to detect changes of information in the function table when the information in the function table is used, even when a plurality of menus exist in the device, the controller is able to

accurately grasp the information of each menu and, at the same time, is able to quickly acquire necessary information as required.

Since the device has a function table that indicates the device function and state, component that composes the function table, and element version information that shows the version of components, and since the controller uses the information of the notification range shown by each component and issues the notification request to the device for requesting notification on information change in the notification range when the information in the function table of the device is used, the controller receives the element version information that corresponds to the notification range as the primary response to the notification request, receives the updated element version information as the secondary response to the notification request when the information within the notification range is changed, even when the state change occurs in the device while the controller is reading the state information. Therefore, the controller is able to immediately detect the state change by the secondary response and can learn of the state change of the device quickly and accurately.

Since the device has a function table that indicates the device function and state, component that composes the function table, and element version information that shows the version of components, and since the controller uses the information of the notification range shown by each component and issues the notification request to the device for requesting notification on information change in the notification range by using the information on the notification range shown with each component when the information in the function table of the device is used, the controller receives the element version information that conforms to the notification range as the primary response to the notification request, and when the information within the notification range is changed, the controller receives the updated element version information as the secondary response to the notification request and reads the information within the notification range between the primary response and the secondary response. Therefore, the controller is able to hold the condition in which the notification request is constantly issued to the device, and even when the device state is changed at any time, the device is able to notify the controller immediately of the change, thereby making it possible to constantly bring the state information of the device which the

controller possesses in agreement with the state information inside the device.

Because the element version information that indicates the component version is the function table version when the component information is changed, the version information is able to be generated for each component with a simple configuration.

Because the component is the menu, the version information can be given in an appropriate unit as the display unit of the controller, and the processing efficiency of the controller can be improved.

Because the component is the display part, the information which the controller requires is able to be specified in a minute unit, and when the component is changed, the transmission efficiency and the processing efficiency are able to be improved.

Because the secondary response from the device contains the updated element version information and updated information, the updated information is able to be quickly transmitted to the controller, and the transmission efficiency is improved and the processing which is required for transmission is able to be simplified.

Fourth Embodiment

With reference to FIG. 19 and FIG. 20, the fourth embodiment according to the present invention will now be described.

FIG. 19 is a block diagram of the function information table that shows the fourth embodiment according to the present invention, and FIG. 20 is an illustration showing one example of the screen display of the fourth embodiment. The controller and device configuration, the protocol when the device information is acquired and the device information parts are the same as those of the first embodiment, and the explanation thereof will be omitted in this section.

In FIG. 19, numeral 51 denotes a function menu list that indicates component assembly parts, numeral 55 denotes an invariable display parts list that possesses invariable data only as the data object, numeral 56 denotes a variable display parts list that contains the variable data as the data object, numeral 70 denotes an invariable data set that indicates a set of invariable data, and numeral 80 denotes a variable data set that indicates a set of variable data. In the fourth embodiment, FIG.

19 shows the logical configuration of the function information table, and the physical layout is optional.

Each part comprises an object of a list form, and data objects which do not have child objects (text objects, still picture object, etc.) and list are generically referred to as objects. That is, for the object information, there are data objects, lists, various header information, and unique information. Each object does not always have to take a list structure, and may be configured with data objects only or with unique information and data objects.

At the header section, each object has an identifier (ID) for identifying each object, type information that shows the type of object, attribute information that indicates the configuration of whether or not it has a child object, etc., size information that shows the size of the object, and others. Similar to the first embodiment, each object shows the child object by the ID information in the entry that is stated in the list.

For the objects such as text objects, etc. which have a small data amount, the objects themselves may be entered in the entry section in the list. The unique information of each list should be entered in the header, etc. in each list and the unique information of the data object should be entered in the entry. In addition, the unique information may be stated in either the object or the entry.

The function menu 51 shows a menu which is an aggregate of display parts (invariable display parts 55 and variable display parts 56) that show device functions, and comprises function menu lists. The function menu list is configured with function menu lists. The function menu list 51 is linked from the menu entry inside the device information list 50, as described in FIG. 4 of the first embodiment and has an entry of operation screen display parts (invariable parts 55) and display parts (variable display parts 56) that would show the list 51 itself as shown in FIG. 19.

By the method of predetermining an ID of the function menu list 51, direct access to the function menu 51 may be obtained without tracing from entries of the device information list. In this event, the display parts for the operation screen and the list itself (invariable parts 55 and variable display parts 56) are arranged by the use of the display parts list, and the data objects are arranged so as to be linked to the entry of the display parts list.

The entry of each display part (invariable parts 55 and variable display parts 56) may be directly arranged in the function menu list without using the display parts list.

Furthermore, the function menu list has the information for configuring the apparatus operation screen, and has the information such as the screen size which the function information table 8 assumes, as well as background color, background patterns, etc. in the header inside, etc. as the unique information.

On the other hand, the data objects (texts, still pictures, etc.) that indicate this function menu list itself have direct entries in the function menu list.

The data object that shows the list itself may be expressed by the use of the display parts list. In addition, the information that shows these lists themselves may be distinguished from other data objects or display parts (invariable parts 55 and variable display parts 56) by the use of flags, etc. That is, the materializing form of the display parts is available in two forms: one to use the display part list and the other to be configured by the data objects only.

The display parts (invariable parts 55 and variable display parts 56) are parts for displaying icons, buttons, sliders, check boxes, text entries, etc. In these display parts lists, the display parts have unique information such as the type of display parts (invariable parts 55 and variable display parts 56), information which is required for each display part (for example, in the case of the slider, variable range, step value, initial value, etc.), etc.

In addition, this display parts list has text objects, still picture objects, and other entries, and in this entry, the display parts list has the unique information such as flags that show the kind of texts and still pictures (format), etc., and furthermore, positional information on the screen for showing the relative position to the menu screen which the device assumed.

In addition, as with the first embodiment, each display part list may have the layout information that shows the mutual relation of display parts with respect to display parts which are in close relation from the functional and screen design viewpoints as relational information that has the same information (for example, same value). In the case of new functions which are unable to be assumed presently, by arranging the still picture, etc. that shows this new function as a display part, the data of this new function is transmitted to the controller, and the information on this new

function is able to be presented to the user. The fact that the user chose this still picture, etc. is notified to the device, and by the device realizing this function, the controller does not need to understand the meaning of this new function and this new function is able to be used easily from the controller.

The data objects which have no possibility to change in accordance with the device state, etc. and the data object of the invariable display parts are stored in the invariable data list 70 which has a list structure. The data objects which have a possibility to change in accordance with the device state and the data object which has a possibility to change in accordance with the device state, etc. of the variable display parts are stored in the variable data list 80 which has a list structure. In this event, the data objects which show the list itself are stored in the same manner either in the invariable data list 70 or in the variable data list 80. In FIG. 19, only the still picture data objects are displayed, but the present invention should not be limited to this only.

The invariable data list 70 is one example of the invariable data set collecting the invariable objects and the variable data list 80 is one example of the variable data set collecting the variable objects.

Because, for example, still pictures that show the device menus and reproduction button, stop button, etc. are not changed by the device state, and even if these display parts are not displayed as part of the menu on the display screen of the controller at the present time, they will never be replaced in the device, and therefore, they are stored in the invariable data list.

Furthermore, with respect to the still picture which looks like a convex form to be used when a button is expressed and the still picture which looks like a concave form to be used when the button is depressed, if the functions shown by these buttons are not changed by the device state, these buttons are stored in the invariable data list.

The contents in the device, for example, still pictures that show each program recorded in the VTR tape (in FIG. 19, marathon meet or gymnastics competition), are highly likely to be deleted from the device because programs that are recorded in the tape differ when the tape is changed. The STB program information, etc. belong to this classification, too. Consequently, the still picture that shows contents in the device is stored in the variable data list 80. That is, data objects

such as changing still pictures, etc. by changing the device state and variable display parts are stored in the variable data list.

FIG. 20 shows one example of the screen display of the fourth embodiment, and the information in the function information table 8 is arranged at the position which is determined by the layout information stated in the function menu list 51, etc.

In this way, by storing the data object in the function information table by dividing a variable object set and an invariable object set, the controller can easily judge whether or not caching is effective for the objects the controller once read, and if effective, by caching the invariable object, the operation screen with the display parts, etc. being quickly updated can be provided to the user. Furthermore, even when the controller is unable to read all the invariable objects, by caching some of the invariable objects in the invariable data set, the operation screen with the display parts, etc. being quickly updated can be provided to the user even in a small memory region.

In addition, it is also possible for the device to assign the priority to the invariable objects in the order of the possibility of frequent use, for the controller to cache by assigning priority to display elements (data objects, display parts, function menus) with many display frequencies, and for the controller to cache by assigning priority to display elements in the order of closeness to the main menu, and in such case, caching can be carried out more efficiently.

It also becomes possible to assign different storage region to the variable data and the invariable data, respectively, in the device, and the storage location of the invariable data can be prevented from being changed by the variable data that changes from hour to hour. This enables data rearrangement such as garbage collection to be carried out for the variable data set only, and device processing can be simplified and the storage region can be efficiently used.

In the fourth embodiment, the still picture is used to explain for storing in the variable data set and in the invariable data set, but this shall not be limited to the still picture only. It is to be understood that this can be applicable to text data and videos, and optional display parts such as sliders and check boxes, as well as function menus, whereby similar effects are obtained.

Furthermore, it is also possible to divide the apparatus information other than objects into the variable data and the invariable data and to register them to the invariable data set and a variable

data set, respectively, and the similar effects are obtained.

In the fourth embodiment, the invariable object set and the variable object set are materialized by using the list structure, but it is also possible to materialize the invariable object set and the variable object set by assigning a variable data flag or invariable data flag to each object.

As described above, according to the fourth embodiment, the device has a plurality of objects that compose the device operation screen, the object comprises the invariable object that is invariable irrespective of the device state and the variable object that is variable in accordance with the device state. Accordingly, while the controller is able to easily detect whether the object is variable data or invariable data by reading the object from the device, carrying out caching for the invariable object, displaying the object on the display screen, and caching, etc. can be carried out effectively, and the resources which the controller possesses can be effectively utilized.

Consequently, even a controller with minimal resources (for example, a storage region) can provide a user with an operation screen that can be quickly updated and achieves good operability by carrying out caching of the data.

The device is able to assign the separate storage region to the variable data and the invariable data, respectively, because the device has an invariable data set that comprises invariable objects only and a variable data set that comprises variable objects, and the storage location of the invariable data can be prevented from being changed by the variable data that changes from hour to hour. This enables data rearrangement such as garbage collection to be carried out for the variable data set only, and device processing can be simplified and the storage region can be efficiently used.

Fifth Embodiment

With reference to FIG. 21, the fifth embodiment according to the present invention will now be described. The configuration of the device and the controller of the fifth embodiment are same as the first and the second embodiments shown in FIG. 1, FIG. 2, FIG. 4 and FIG. 9, and therefore, any explanation of overlapping sections will be omitted. The control operation are the same as the control operation of the second embodiment except that the version information is included in

the menu list response 211, display parts response 231, operation request 241, and object response 272.

Referring now to FIG. 21, the control operation of the controller and the device of the network control system in the fifth embodiment will be described as follows.

First of all, when the device is connected to the transmission line 1, the controller on this transmission line 1 recognizes the new device by bus resetting, etc., reads the device information part 50 from the new device through the transmission line 1 by the instruction of the function information table managing means 12, and reads and registers this device information part 50 to the function information table 8 of the function database 13 of the controller.

The display/function selection means 14 refers to the function information table 8 or to part of the function information table 8 in the function database 13 through the function information table managing means 12.

When the display/function selection means 14 displays a table to devices which are connected to this controller, the display/function selection means 14 uses the function information table managing means 12 to read the data objects (text objects, still picture objects, etc.) that belong to the device information parts 50 from the function information table of all the devices that are registered to the function database 13, and displays these on the screen.

Then, when the user selects, for example, the device still picture object (still picture that belongs to the device information part 50) by using the pointing function (for example, crosshair), etc. of the remote controller, the display/function selection means 14 issues a request for the main menu to the function table managing means 12, and the function information table control means 12 reads the function menu 51 that shows the main menu of this device and the display parts that belong to this function menu 51, and stores them in the function information table 8 in the controller.

In such an event, first of all, the controller transmits the notification request 101 shown in FIG. 21 to the device as a command and declares that the controller grasps the device condition and controls its action. As a response to this, the device returns the primary response 111. In this primary response 111, the version information of the function information table 8 that indicates the

function of the device is contained.

In addition, in this notification request 101, the information on the notification range that indicates the range the controller hopes to bring the information to coincide with the device is included.

The version information of the function information table is updated (incremented) when the information inside the device is changed. Consequently, the information other than the notification range is changed, and the version information of the function information table is updated. The version information is also updated when the component set parts, etc., which are sets of function menu in the notification range and display parts 52, and display parts 52 located below this are changed. The version information may be configured in such a manner so as to indicate the version of the whole device including the device information parts 50 and function menu 51 and the display parts 52 located below this.

For the primary response 111, the identifier (ID) of the main function menu 51, which is the main inside the device, may be returned, and in such an event, the device is enabled to easily change its main menu.

In order to acquire the contents of the function menu 51, the function information table managing means 12 in the controller transmits the menu request 201 to the device, and the device returns the list of identifiers (ID) of the display parts 52 that belong to the function menu 51 as the menu list response 211', which is the response to this menu request 201.

The function information table managing means 12 sends a display parts request 221 with the identifier of the display parts 52 attached thereto in order to acquire the entity of each display part and acquires each display part 52 at the display part response 231', which is the response to this display parts request 221.

In each menu list response 211' and display parts response 231', the version information at the present point is included. Consequently, it becomes possible to check the state change of the device while the controller is acquiring the data of the function menu by these pieces of version information, and the information inside the function menu is able to be quickly updated. Furthermore, it becomes possible for the target to change the information in the function menu at

an optional timing, and this can simplify the target processing, reduce the memory region, and increase the processing speed.

In this way, the information of the device function information table 8 is read by the function information table managing means 12.

Consequently, the display/function selection means 14 reads the display parts 52 from the function information list of each function that is mentioned in the function menu list by using the function information table managing means 12, and displays the display parts 52 corresponding to each function on the screen. By this, on the screen, it becomes possible to display the display parts 52 that show all the functions of this device.

In this case, the identification of each display part 52 is carried out by the unique ID of the device and the ID of each of the display parts 52.

Next, when the user selects the display parts 52 that show, for example, reproducing functions of the device by using the pointing functions, etc. of the remote controller, the display/function selection means 14 transmits the identifier control code (ID) of the display parts 52 that are designated by the device, the version information which the controller possesses, and the user operation information (for example, "selection") to the device as operation request 241'.

Consequently, even when the device updates the contents of the function menu nearly simultaneously with the user operation, the device is able to know which menu the user referred to when the user carried out the operation, and the device can carry out optimum processing in accordance with individual cases. For example, if the user operates the display part which is not related to the display parts that are changed by the menu, the device accepts the operation, and when the user operates the changed display part itself, the device is able to reject the operation.

As responses to the operation request, in the operation response 251, responses such as whether or not the operation request 241' is received, rejected, not supported by the device are returned.

Then, when the state in the device changes and the objects (function menu list, display parts list, data object) in the device change, the device returns the secondary response 121 to the notification request 101. In this secondary response 121, the incremented version information and

identifiers (ID) of objects changed are included.

The function information table managing means 12 detects that objects in the device have changed by receiving this secondary response 121, and by using the identifier of the changed object, requests the changed object. Before requesting the changed object, the secondary notification request 102 is sent to the device. For this response, the primary response 112 is obtained. In this primary response 112, the version information of the device is included.

First of all, when the version information that is contained in the primary response 112 of the notification request 102 is the same at the version information of the secondary response 121, since the device state is not changed from the secondary response 121, the difference between the controller information and the device information is the object that is notified by the secondary response 121. Consequently, this object is requested by the object request 262 and the object that is changed by the object response 272', which is the response to this, is obtained. For example, if the changed object is the function menu 51 (if the identifier of the function menu list is notified in the secondary response 121), the menu request is carried out as this object request, and for the object response, the menu list response is obtained, the function menu list is acquired, and the controller checks the display parts list that is changed in the function menu list, requests the display parts to the changed display parts list, and acquires the data object of the display parts 52 by the display parts response.

In these object responses, the version information is included, and by this information, the controller is able to check the device state change while the controller is acquiring the data of the function menu, and the information in the function menu is able to be quickly updated.

On the other hand, when the version information of the second primary response 112 differs from the version information of the secondary response 121, the difference between the controller information and the device information is not definite. That is, because the version information is incremented each time the information inside the device changes differs, the information in the device is changed between the secondary response 121 and the primary response 112. Consequently, in this event, the controller first reads the list (function menu list, display parts list, etc.) only of the objects in the notification range held by the controller in the object request 262.

The controller judges whether the identifier (ID) of each object that is stated in this list coincides with the identifier (ID) of the objects in the information held in the controller, and sends the objects with only the difference to the device as the object request (not illustrated in FIG. 21) and obtains them in the object response (not illustrated in FIG. 21).

Consequently, it becomes possible to bring the information the controller holds to coincide with the information of the device even when the data object only is changed or the list itself is changed. Consequently, it is no longer necessary to use the information of the updated object which is acquired in the secondary response 121. Thereafter, the controller updates the version information of the function information table 8 in the controller.

In this way, by constantly making the notification request before the controller acquires the device information, the time the controller does not make the notification request to the device can be reduced and the device change can be quickly and definitely acquired.

After the function information table 8 in the controller is updated, the function table managing means 12 instructs the display/function selection means 14 to update the screen display, and the display/function selection means 14 updates the screen.

It is stated that the identifier of the changed object is included in the secondary response 121, but when the object entity (for example, when the display part is changed, the display parts list and the data object that belongs to this list) may be transmitted as the secondary response, the display parts request 221 and the display parts response 231' are no longer needed and processing is able to be simplified.

It is also possible to allow the operation response 251 to have the information that indicates the state change in the device that is generated directly for the operation request 241', and in such an event, the secondary response 121 may be transmitted when changes other than this state change are directly generated. For example, for changes of the still picture on the operation screen (from convex display to concave display) for the operations such as pressing and releasing of the button on the operation screen, etc., a quick response is able to be obtained, whereby the number of frequencies to carry out the notification request can be reduced, and the traffic of the transmission line 1 can be reduced.

In addition to the requests/responses, etc. shown in the fifth embodiment, communication may be carried out between the controller and the device, and although it is not illustrated, for example, it may be configured to return the recognition signal for confirming that the other party has received each request and response.

As described above, by providing the menu list response 211', display parts response 231', and object response 272' with the version information, it becomes possible for the controller to check the device state change while the controller is acquiring the data of the function menu, thereby making it possible to quickly update the information in the function menu. Furthermore, the target is able to change the information in the function menu in an optional timing, the target processing can be simplified, the memory region can be reduced, and processing speed can be increased.

When the user operates the display part, by sending the identifier of the display part 52, version information which the controller possesses, and the information which the user operated to the device, and even when the device updates the contents of the function menu nearly simultaneously with the user operation, the device is able to know which menu the user referred to when the user carried out the operation, and therefore, the device can carry out optimum processing in accordance with individual cases. For example, if the user operates the display part which is not related to the display parts that are changed by the menu, the device accepts the operation, and when the user operates the changed display part itself, the device is able to reject the operation.

INDUSTRIAL APPLICABILITY

According to the first embodiment of the present invention, the device possesses the state information that indicates the device state and the version information that indicates the version of the state information, and when the state information is updated, the relevant version information is updated. By reading the state information and the version information from the device, the controller is able to easily detect the device state change and, at the same time, is able to definitely identify the state information in the device without any problems even when the state change inside the device occurs due to control of other controllers or a spontaneous change inside the device.

The device has the state information that indicates the device condition and version information that indicates the version of the state information, and the version information is updated when the state information is updated. The controller issues the notification request to the device for requesting the notification on the change, and the controller receives the version information as the primary response to the notification request. When the state information is changed inside the device, the controller receives the updated version information, and as a result, it is not necessary for the controller to constantly monitor the device by polling, etc., thereby making it possible to simplify the controller processing. At the same time, since the device that has caused the state change spontaneously notifies the controller of the state change, the controller is able to quickly detect the state change inside the device.

It becomes possible to transmit the updated state information only by including the updated version information and updated state information (identifier) in the secondary response from the device, and the traffic of the transmission line can be reduced. Furthermore, by including the updated state information (state information itself), since the controller is no longer needs to read the changed state information after the controller detects the state change, processing of the controller is able to be simplified, and, at the same time, on the device side, a problem of enabling the controller to read the state information is eliminated, and the traffic of the transmission line is able to be further reduced.

The device has the operation screen information that indicates the device operation screen and the version information that indicates the version of the operation screen information. The controller reads the operation screen information and the version information from the device, and detects the change of the device operation screen information by the version information, thereby making it possible for the controller to easily detect changes of the device state due to instructions from other controllers or spontaneous changes inside the device, and, at the same time, enabling the controller to easily and definitely identify the operation information that correctly reflects the device condition.

One or more devices are included, and each device comprises one or a plurality of objects and has the operation screen information that indicates the device operation screen and the version

information that indicates the version of the operation screen information. The controller issues the notification request to the device for requesting the notification on the change if any state information is changed, and the controller receives the version information as the primary response to the notification request. When the state information is changed inside the device, the controller receives the updated version information, and as a result, it is not necessary for the controller to constantly monitor the device by polling, etc., thereby making it possible to simplify the controller processing, and at the same time, since the device that has caused the state change spontaneously notifies the controller of the state change, the controller is able to quickly detect the state change inside the device. Consequently, the controller is able to quickly present the latest operation information to the user and provide a user-friendly interface to the user.

It becomes possible to transmit the updated object information only by including the updated version information and updated object information (identifier) in the secondary response from the device, and therefore, the traffic of the transmission line can be reduced. Furthermore, by including the updated object information (object itself), since it is not necessary for the controller to read the changed object after the controller detects the operation screen information change, processing of the controller is able to be simplified, and at the same time, on the device side, a problem of enabling the controller to read the state information is eliminated, whereby the traffic of the transmission line is able to be further reduced. Consequently, the controller is able to quickly present the screen update to the user and the improved operability and visibility of the operation screen are achieved.

Because the version information is the counter value that is incremented each time the information inside the device is updated, the reliable version information is able to be created by a simple configuration and by simple processing.

According to the second embodiment of the present invention, the device possesses the state information that indicates the device state and the version information that indicates the version of the state information, and the version information is updated when the state information is updated. The controller issues the notification request for requesting notification of change of the state information to the device when the controller uses the device state information, and receives the

version information as the primary response to the notification request. When the state information is changed in the device, the controller receives the updated version information as the secondary response to the notification request, and the controller reads the state information between the primary response and the secondary response. By doing so, even when any change occurs in the state in the device while the controller is reading the state information, the controller is able to immediately detect the state change in the secondary response, and is able to know the state change of the device quickly and accurately.

In addition, by issuing the notification request before the controller reads the state information of the device, the controller is able to hold the condition so as to constantly issue the notification request to the device. Further, even if the device state is changed in any case, the device is able to notify the controller of the change immediately, and the state information of the device that the controller holds is able to be brought to coincide with the state information inside the device.

According to the third embodiment of the present invention, since the device has a function table that indicates the device and its state, components that compose the function table and element version information that shows the version of components of the function table, and since the controller uses the element version information to detect changes of information in the function table when the information in the function table is used, even when the function and the state are changed inside the device due to controls from other controllers or spontaneous change inside the device, the controller can easily detect the change, and, at the same time, the controller can definitely identify the state information in the device without any problems. Furthermore, since the device has version information component by component, the controller is able to meticulously grasp the device function and state and, at the same time, since the changes of the component are able to be directly detected, it is easy to acquire the information of the changed component when the changed information is acquired, thereby making it possible to simplify the controller processing and to improve the processing efficiency. Furthermore, since the changed component is directly accessed by the controller, the better efficiency in processing is achieved also for the device.

Since the device has a function table that indicates the device function and its state, components that compose the function table and element version information that shows the version of components, and since the controller uses the function table version information to detect changes of the information in the function table and uses element version information to detect changes of information in the components when the component information in the function table is used, when the controller displays all the information of the function table or only one menu, etc., the device is able to notify the information that is changed which the controller desires in accordance with the request of the controller, and the controller is able to accurately grasp the device information and, at the same time, highly efficient processing with less waste in the transmission line and processing can be achieved.

Since the device has a function table that indicates the device function and state, a plurality of components that compose the function table and element version information that shows the version of components for each component, and since the controller uses the element version information to detect changes of information in the function table when the information in the function table is used, even when a plurality of menus exist in the device, the controller is able to accurately grasp the information of each menu and at the same time, is able to acquire necessary information quickly as required.

Since the device has a function table that indicates the device function and state, component that composes the function table and element version information that shows the version of components, and since the controller uses the information of the notification range shown by each component and issues the notification request to the device for requesting notification on information change in the notification range when the information in the function table of the device is used, the controller receives the element version information that corresponds to the notification range as the primary response to the notification request, and receives the updated element version information as the secondary response to the notification request when the information within the notification range is changed. Accordingly, even when the state change occurs in the device while the controller is reading the state information, the controller is able to immediately detect the state change by the secondary response and can learn of the state change of

the device quickly and accurately.

Since the device has a function table that indicates the device function and state, component that composes the function table and element version information that shows the version of components, and since the controller uses the information of the notification range shown by each component and issues the notification request to the device for requesting notification on information change in the notification range by using the information on the notification range shown with each component when the information in the function table of the device is used, the controller receives the element version information that conforms to the notification range as the primary response to the notification request. Furthermore, when the information within the notification range is changed, the controller receives the updated element version information as the secondary response to the notification request, and reads the information within the notification range between the primary response and the secondary response, and therefore, the controller is able to hold the condition in which the notification request is constantly issued to the device. Moreover, even when the device state is changed at any time, the device is able to notify the controller immediately of the change, thereby making it possible to constantly bring the state information of the device which the controller possesses in agreement with the state information inside the device.

Because the element version information that indicates the component version is the function table version when the component information is changed, the version information is able to be generated for each component with a simple configuration.

Because the component is the display part, the information which the controller requires is able to be specified in a minute unit, and when the component is changed, the transmission efficiency and the processing efficiency are able to be improved.

Because the secondary response from the device contains the updated element version information and updated information, the updated information is able to be quickly transmitted to the controller, and the transmission efficiency is improved as well as the processing required for transmission is able to be simplified.

According to the fourth embodiment of the present invention, the device has a plurality of

objects that compose the device operation screen, where the object comprises the invariable object that is invariable irrespective of the device state and the variable object that is variable in accord with the device state. While the controller is able to easily detect whether the object is variable data or invariable data by reading the object from the device, the controller carries out caching for the invariable object, displaying the object on the display screen, and caching, etc. effectively, and therefore, the resources which the controller possesses can be effectively utilized.

Consequently, even a controller with limited resources (for example, a storage region) can provide a user with an operation screen that can be quickly updated and achieves good operability by carrying out caching of the data.

The device is able to assign the separate storage region to the variable data and the invariable data, respectively, because the device has an invariable data set that comprises invariable objects only and a variable data set that comprises variable objects, and the storage location of the invariable data can be prevented from being changed by the variable data that changes from hour to hour. This enables data rearrangement such as garbage collection to be carried out for the variable data set only, and device processing can be simplified and the storage region can be efficiently used.

According to the fifth embodiment of the present invention, by providing the menu list response, display parts response, and object response with the version information, it becomes possible for the controller to check the device state change while the controller is acquiring the data of the function menu, thereby making it possible to quickly update the information in the function menu. Furthermore, the target is able to change the information in the function menu in an optional timing, and the target processing can be simplified, the memory region can be reduced, and processing speed can be increased.

When the user operates the display part, by sending the identifier of the display part, version information which the controller possesses, and the information which the user operated to the device, and even when the device updates the contents of the function menu nearly simultaneously with the user operation, the device is able to know which menu the user referred to when the user carried out the operation, and the device can carry out optimum processing in accordance with

individual cases. For example, if the user operates the display part which is not related to the display parts that are changed by the menu, the device accepts the operation, and when the user operates the changed display part itself, the device is able to reject the operation.

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